The STEMin Lesson Plans Guide

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INDEX

LESSON PLANS

For 6-9 years old students

For 10-12 years old students

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STEM in

INTRO

WHAT'S IN THIS GUIDE?

STEM-IN is an Erasmus+ initiative aimed at fostering STEM education in young learners through engaging, hands-on lesson plans.

This guide provides primary school teachers working with students aged 6-12 with clear instructions on how to effectively implement the STEM-IN lesson plans. It ensures teachers can confidently deliver hands-on STEM activities, engage students in scientific inquiry, and create an interactive learning environment.

Each lesson is tailored to either 6-9 years old or 10-12 years old, ensuring that activities are developmentally appropriate.

Topics covered in the lesson plans

- Physics
- Chemistry
- Environmental Science
- Engineering
- Coding

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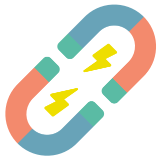
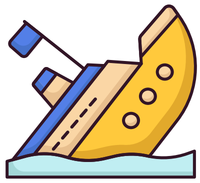
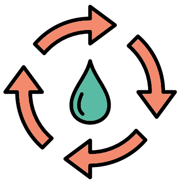
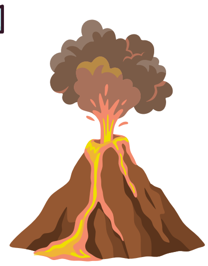
STEM in

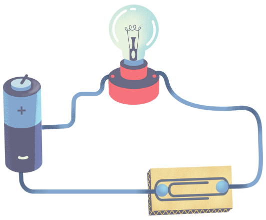
INTRO

12 LESSON PLANS

For 6-9 years old students

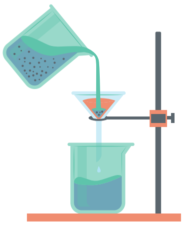
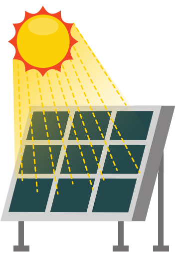
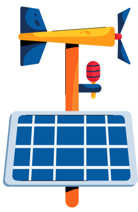
- Floating and Sinking
- The Magic of Magnets
- The Water Cycle Adventure
- Mini erupting volcano
- Generation of static electricity
- Experiment "Soluble-insoluble"




For 10-12 years old students

- Building a simple circuit
- Coding a simple game in Scratch
- Designing and testing paper bridges
- Water purification experiment
- Weather station
- Create your own solar oven

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WHY IS THIS GUIDE USEFUL?

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WHY IS THIS GUIDE USEFUL?

This guide is a teacher's best ally in bringing STEM concepts to life in the classroom. Instead of spending hours searching for activities or designing experiments from scratch, educators have ready-to-use, structured lesson plans tailored to engage young learners. It provides step-by-step instructions, materials lists, and assessment criteria, ensuring that every lesson is interactive, educational, and fun.

Beyond just content, the guide also empowers teachers with classroom management tips, gamification strategies, and adaptations for diverse learners, making STEM learning accessible to all students. It transforms traditional teaching into an engaging, hands-on journey where curiosity drives discovery. Ultimately, this guide makes STEM lessons easier to implement, more impactful, and deeply enjoyable for both teachers and students.

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GUIDANCE FOR TEACHERS

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GUIDANCE FOR TEACHERS

ON HOW TO IMPLEMENT THE LESSON PLANS

To effectively implement the lesson plans, teachers should begin by thoroughly familiarizing themselves with the lesson content and preparing materials in advance.

Once ready, they should organize the classroom to facilitate hands-on activities and group work, which will enhance student engagement. As the lessons progress, it is important to encourage students to predict outcomes, conduct experiments, and reflect on their results to develop critical thinking skills.

Simultaneously, managing time efficiently by setting clear objectives while allowing flexibility for discussions will ensure a smooth learning process. Furthermore, incorporating real-life examples will help students relate lessons to their everyday experiences, fostering both curiosity and inquiry-based learning. In addition, integrating technology, such as digital simulations or multimedia resources, can further enrich understanding.

Finally, to ensure an inclusive environment, teachers should adapt lessons to accommodate different learning styles and abilities, creating an engaging and supportive classroom experience for all students.

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GAMIFICATION TECHNIQUES

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GAMIFICATION TECHNIQUES

TO EXCEL IMPLEMENTING THE LESSON PLANS

Gamification enhances student engagement by incorporating game-like elements into the learning process.

By integrating these strategies, teachers can make STEM lessons more interactive, motivating, and effective.

1. Points and rewards system

Assign points for completing tasks, participating in discussions, or solving challenges. Offer small incentives like badges, certificates, or classroom privileges to encourage active participation.

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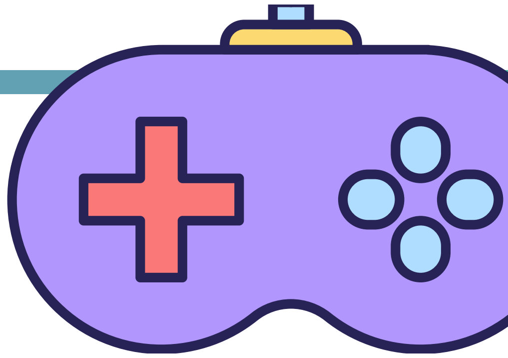
GAMIFICATION TECHNIQUES

TO EXCEL IMPLEMENTING THE LESSON PLANS



2. Level progression and unlocking challenges

Structure lessons like a game, where students must complete basic activities to unlock more advanced experiments. This method fosters curiosity and a sense of achievement.

3. Leaderboards and friendly competition

Introduce friendly competition by tracking progress on a class leaderboard. Recognize individual and team efforts to promote collaboration while maintaining a fun and encouraging atmosphere.

4. Role-playing and storytelling

Transform lessons into immersive experiences by incorporating storytelling. For example, students can become "scientists on a mission" or "engineers solving a real-world problem," making lessons more relatable and exciting.

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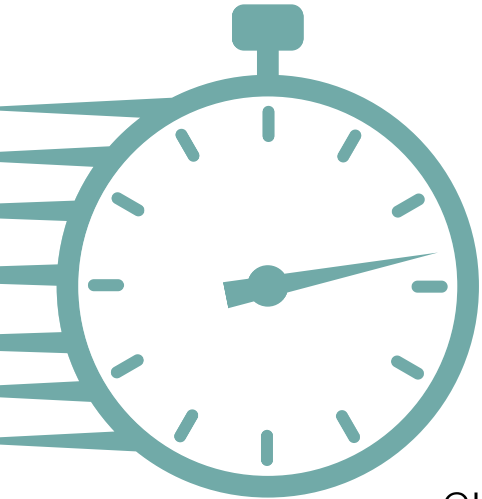
GAMIFICATION TECHNIQUES

5. Mystery and problem-solving scenarios
Present STEM activities as problem-solving missions where students must experiment and discover solutions. Mystery-based learning, such as "solving a crime with chemistry" or "building a bridge to save a stranded explorer," makes learning more engaging.

6. Escape room or puzzle-based learning
Create science-based puzzles or escape room-style challenges where students must apply STEM concepts to unlock clues and complete objectives. These activities promote teamwork and logical reasoning.



7. Time-based challenges and mini contests
Set up time-limited challenges where students must complete an experiment or solve a problem within a given timeframe. This keeps lessons exciting and enhances problem-solving under pressure.

8. Integration of digital gamification tools
Use educational platforms like Kahoot!, Quizizz, or Classcraft to add quizzes, interactive polls, and reward systems. These tools provide instant feedback and make learning more interactive.

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TIPS & TRICKS

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STEM in

TIPS & TRICKS

FOR TEACHERS TO USE IN THEIR CLASSROOM

1 Start with a Hook

Capture students' attention with a fun question, real-world example, or quick experiment before diving into the lesson.

2 Encourage Hands-On Learning

Let students explore concepts through experiments and interactive activities rather than passive listening.

3 Use the Power of Storytelling

Frame lessons as exciting adventures or real-world challenges to make STEM concepts more relatable.

4 Foster Collaboration

Encourage teamwork through group projects, discussions, and peer-to-peer learning activities.

5 Incorporate Gamification

Use point systems, rewards, or small competitions to increase engagement and motivation.

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STEM in

TIPS & TRICKS

FOR TEACHERS TO USE IN THEIR CLASSROOM

6 Make Use of Technology

Integrate digital tools like interactive simulations, videos, or coding apps to enhance learning.

7 Adapt to Different Learning Styles

Use a mix of visual, auditory, and kinesthetic methods to ensure every student can grasp the material.

8 Ask Open-Ended Questions

Challenge students to think critically and explore multiple solutions instead of just memorizing facts.

9 Create a Safe Experimentation Space

Encourage students to test ideas, make mistakes, and learn through trial and error without fear of failure.

10 Connect Lessons to Everyday Life

Relate STEM concepts to students' daily experiences to spark curiosity and show real-world applications.

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ADAPTATIONS & DIFFERENTIATION

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ADAPTATIONS & DIFFERENTIATION

FOR DIVERSE LEARNERS

To make STEM lessons accessible to all, teachers can adjust activities based on students' needs. Simplify instructions, break tasks into smaller steps, and offer alternative ways to complete activities, such as using visuals instead of text.

- For multilingual learners, support understanding with hands-on demonstrations, peer collaboration, and culturally inclusive examples.
- Adapt to different skill levels by providing extra guidance for those who need it and extension challenges for advanced students.
- Allow flexible pacing so everyone can engage at their own speed. Small modifications create an inclusive and engaging learning environment for all.

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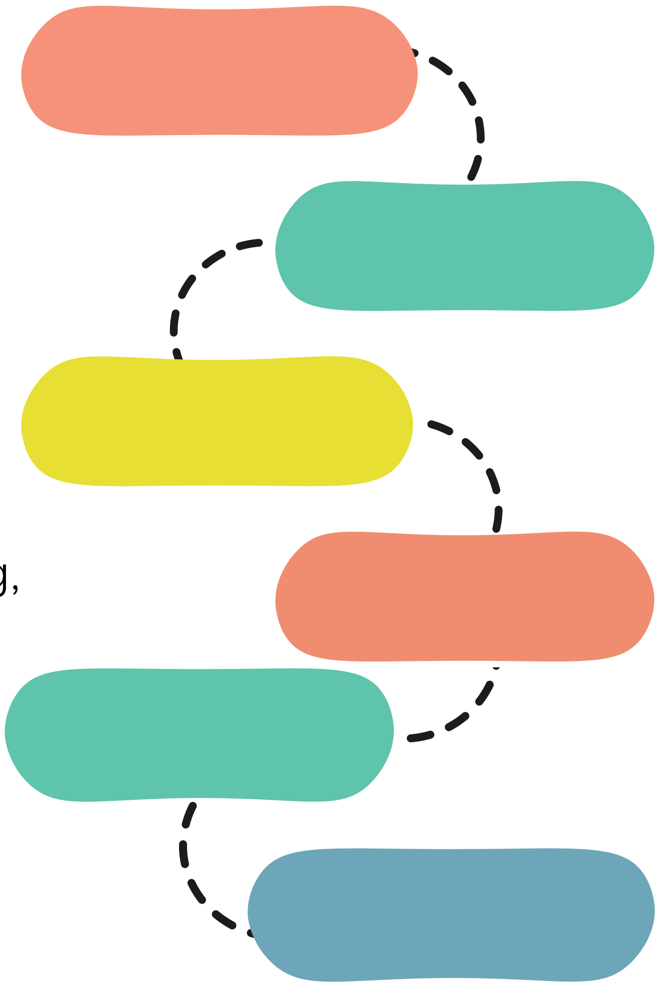
ADAPTATIONS & DIFFERENTIATION

MODIFYING LESSONS FOR DIVERSE LEARNERS

- Provide simplified instructions or visual step-by-step guides for students who may struggle with reading comprehension.
- Break complex tasks into smaller, manageable steps to help students process information gradually.
- Offer alternative ways to complete tasks (e.g., drawing observations instead of writing, using videos instead of text).



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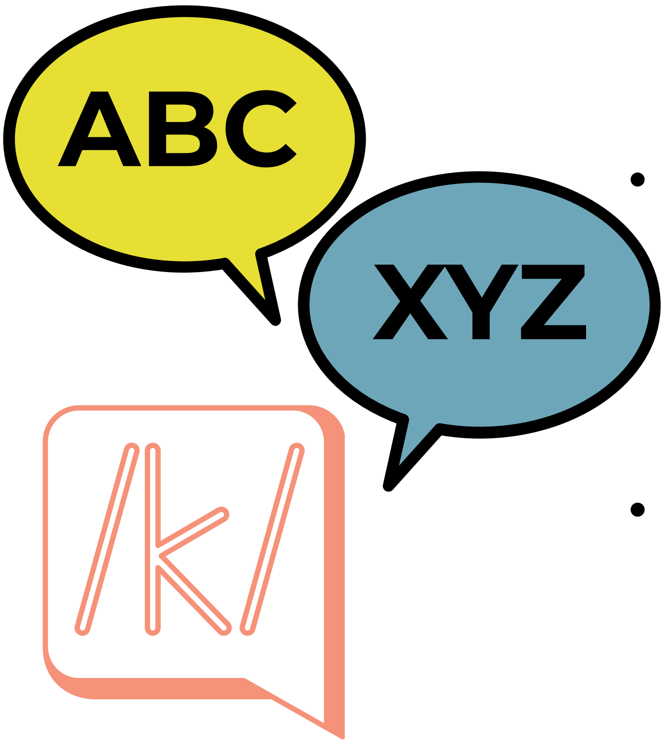
ADAPTATIONS & DIFFERENTIATION

CULTURAL AND LINGUISTIC CONSIDERATIONS

- Use visual aids, real-life objects, and hands-on activities to support multilingual students or those learning the language



- Encourage peer collaboration, pairing students with different language proficiencies for mutual support.
- Ensure that examples, stories, and problem-solving scenarios are culturally diverse and relatable to all students.

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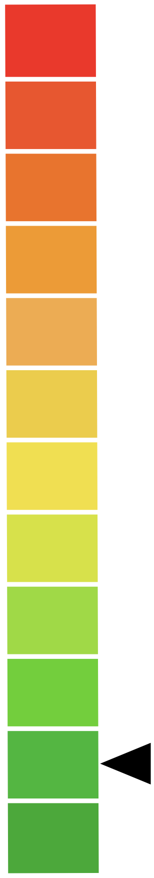
ADAPTATIONS & DIFFERENTIATION

SUGGESTIONS FOR VARIOUS SKILL LEVELS



- For students needing extra support, provide guided worksheets, sentence starters, or scaffolding techniques.
- For advanced learners, offer extension tasks such as designing their own experiments or researching real-world applications.
- Allow for flexible pacing, letting students work at their own speed or revisit concepts through additional resources.

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STEM in

LESSON PLANS

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For 6-9 years old students

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STEM in

Floating
and
Sinking

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STEM in

LESSON PLAN

Floating and sinking

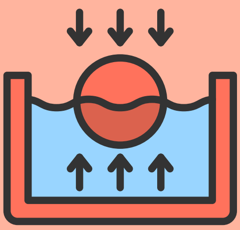
Students will predict and test whether objects float or sink, gaining an understanding of buoyancy and density. They will then design and build a small raft using straws and tape, testing its ability to float and hold weight, and discussing real-world applications like boats and submarines.

45 min **Duration**

Recommended age for this game

6-9 years old

Learning Objectives



- Understand why some objects float while others sink based on buoyancy and density.
- Explore real-life applications of buoyancy, such as boats and submarines.

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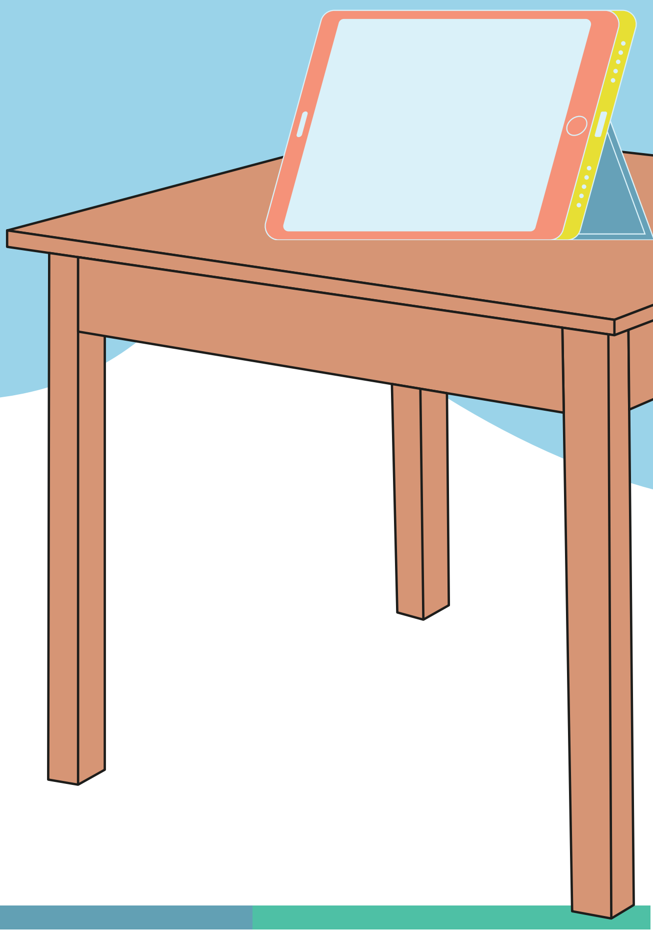
Materials and tools needed

- Large clear container filled with water
- A variety of objects (wood, metal, plastic, rubber, sponge, etc.)
- Straws and tape (for raft-building challenge)
- Coins or marbles (to test how much the raft can hold)
- Printable worksheet for predictions and observations (see references)
- Optional: Digital animations or online simulations on buoyancy (see references)



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Guidance for Teachers

Activity description

- Students will explore buoyancy by predicting and testing which objects float or sink. They will design and build a small raft using straws and tape to test how well it floats and supports weight. The activity encourages experimentation, problem-solving, and discussion on real-world applications like boats and submarines.
- Introduction and Demonstration: The teacher introduces buoyancy with a discussion and simple floating and sinking experiment.
- Hands-on Experimentation: Students test a variety of objects in water, record their observations, and analyze the results.
- Raft-Building Challenge: Students design and construct a floating raft using straws and tape, testing its buoyancy with small weights.
- Technology Integration: Students interact with an online buoyancy simulator to explore how shape, material, and mass affect floating and sinking.
- Discussion and Reflection: Students share their findings, discuss real-world applications, and consider how to improve their raft designs.

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Guidance for Teachers

Preparation

- Gather a variety of materials to test for floating and sinking.
- Fill a large container with water for class demonstrations.
- Prepare a digital animation or simulation explaining buoyancy.
- Provide students with worksheets to record predictions and results.

Implementation steps

1. Introduction and prediction

- Discuss the concept of buoyancy and why some objects float while others sink.
- Show examples of floating and sinking objects and ask students to predict outcomes.

2. Experimenting with objects

- Distribute various objects to small groups.
- Have students test each object in the water and record whether it floats or sinks.
- Discuss results as a class and introduce the concept of density affecting buoyancy.

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3. Raft-Building challenge

- Give each student a set of straws and tape and challenge them to design a floating raft.
- Have students test their rafts by placing them in water and adding small weights (coins, marbles, etc.).
- Encourage students to redesign and improve their rafts based on observations.

4. Discussion and reflection

- Discuss which raft designs worked best and why.
- Ask students: How would you improve your raft design?
- Show a real-world example of how engineers design boats and submarines.
- Conduct a short quiz or class discussion to reinforce learning.

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Follow-up and reflection

- Expected outcome:
    - Students will understand why objects float or sink based on buoyancy and density.
    - Students will apply their knowledge to design and improve floating structures.

- Student activities:
    - Interactive quiz on floating and sinking concepts (See Annex 1 for the questions).
    - Draw and label their raft designs, explaining why they worked or failed.
    - Discuss real-world applications of buoyancy in transportation and safety.

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Student Activities

Activity description	Expected outcome	Technology integration
Predict Floating and Sinking	Students will use reasoning skills to guess which objects will float or sink.	Use an interactive buoyancy quiz to test predictions.
Testing Objects in Water	Students will observe and classify objects based on buoyancy.	Record observations and compare with an online simulator.
Raft-Building Challenge	Students will experiment with materials and structures to create a floating raft.	Explore an interactive buoyancy simulation.
Discussion and Reflection	Students will explain what they learned and apply it to real-world situations.	Use a virtual whiteboard for brainstorming improvements.

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Reflective questions for students

- What surprised you the most about which objects floated or sank?
- How does the shape of an object affect whether it floats or sinks?
- If you redesigned your raft, what changes would you make and why?
- Can you think of any real-life situations where understanding buoyancy is important?

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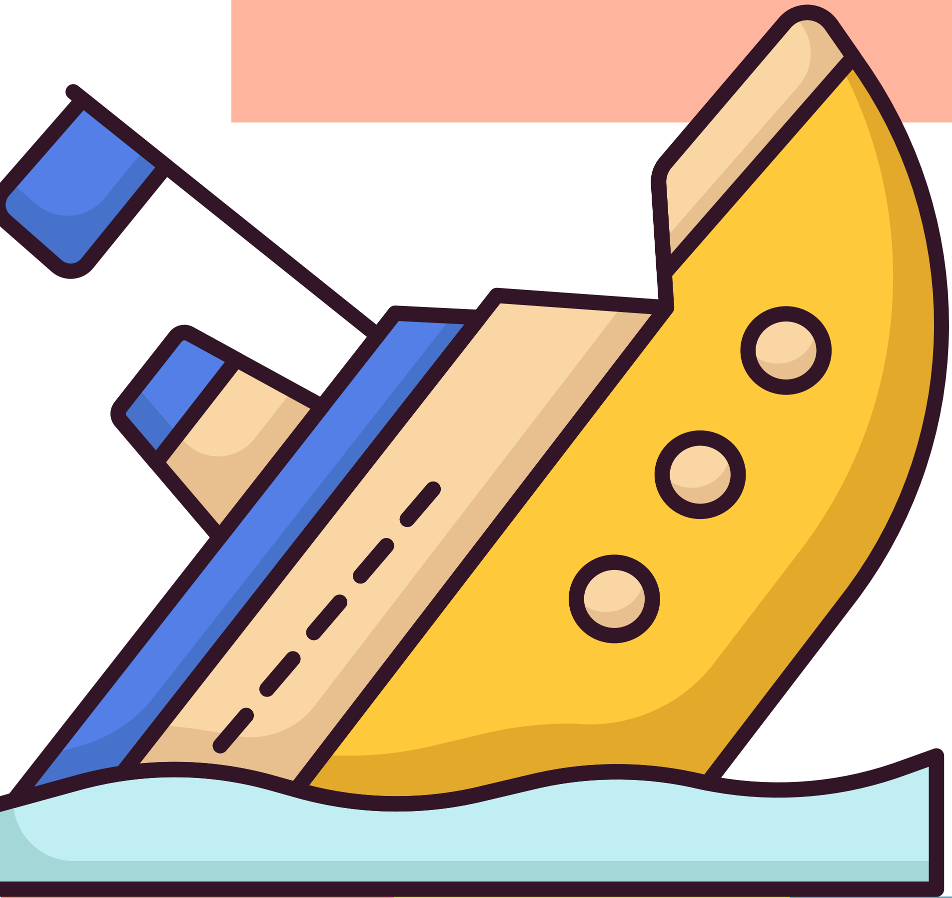
Differentiation ideas

- For advanced students: Challenge them to design a raft using different materials and test variations in weight distribution.
- For students with special needs: Provide step-by-step guidance and allow tactile exploration with objects before predictions.



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Tips

- Ask students to explain why they think an object will float or sink before testing.
- Show videos or diagrams of boats, submarines, and life vests to relate the concept to everyday life.
- Assign small groups for testing objects and designing rafts to foster collaboration.
- Let students experiment with different raft shapes and materials to discover what works best.
- Connect the concept to cargo ships, swimmers, and floating toys.
- Provide tactile experiences, visual media, and discussion opportunities for diverse learners.

Additional materials and references

Floating or Sinking game
Video “How Do Boats Float?”
Example of the Worksheet for “Sink or Float?”
Kahoot

VILLAFUENTE ASOCIACIÓN

ALYTAUS VIDZGIRIO MOKYKLA 1977

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ANNEX 1

Questions for the quiz

1. Why do some objects float while others sink?
A) Because of their color
B) Because of their weight
C) Because of buoyancy and density
D) Because of the shape of the container

2. Which of the following materials is most likely to sink in water?
A) Wood
B) Plastic
C) Metal
D) Sponge

3. What happens if an object is less dense than water?
A) It sinks to the bottom
B) It floats on the surface
C) It disappears in the water
D) It dissolves in the water

4. What is an example of a real-world application of buoyancy?
A) A car driving on the road
B) A boat floating on a river
C) A bird flying in the sky
D) A tree growing in a forest

5. How can you increase the buoyancy of an object?
A) Make it heavieR
B) Make it smaller
C) Increase its surface area and trap air inside
D) Push it to the bottom of the water

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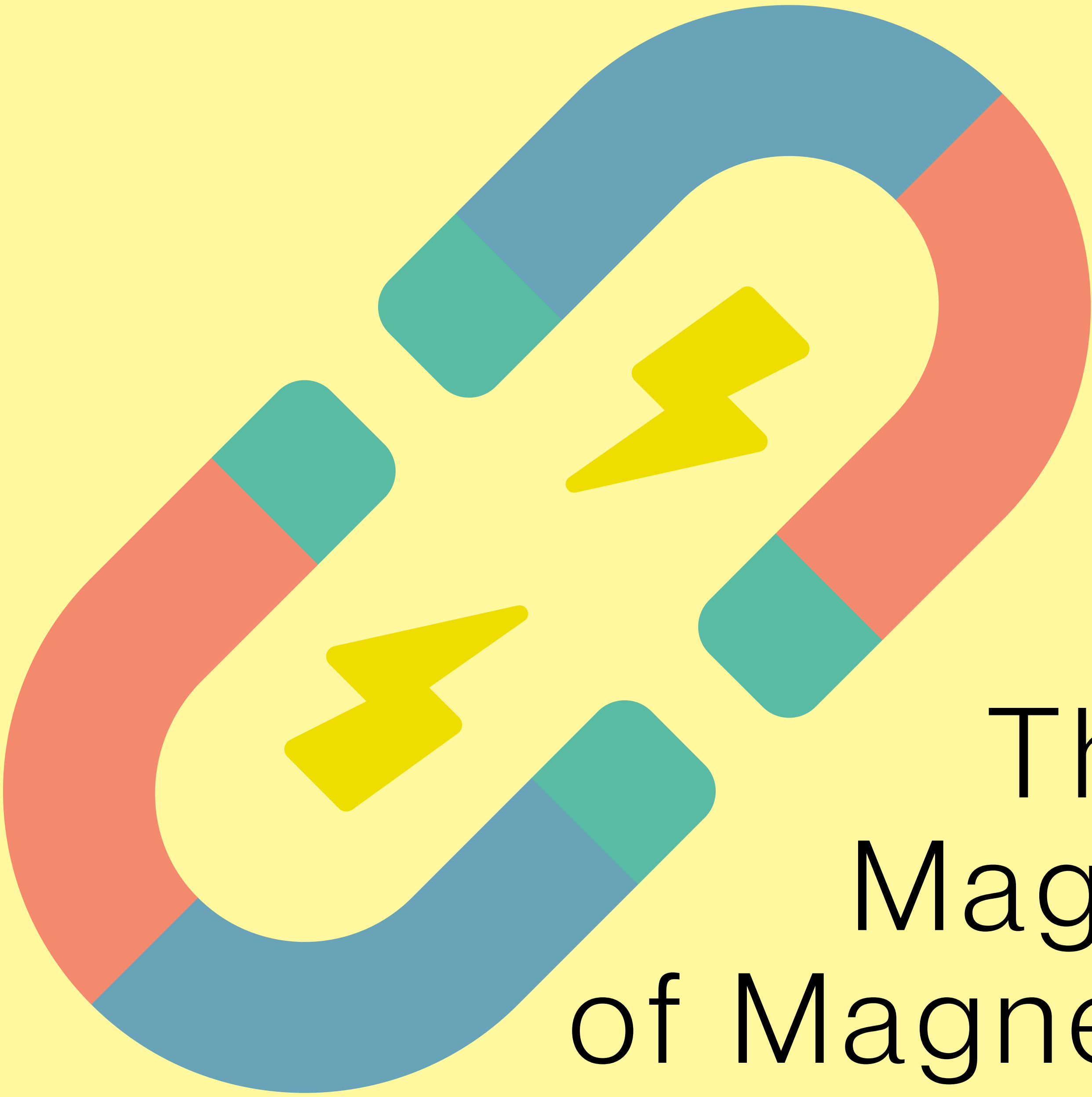

The Magic of Magnets

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STEM in

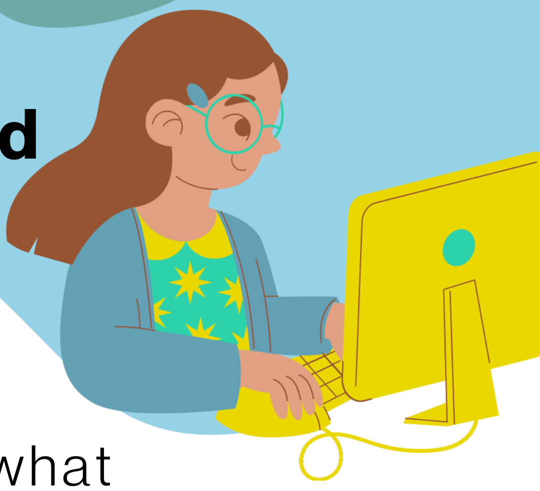
LESSON PLAN

The Magic of Magnets

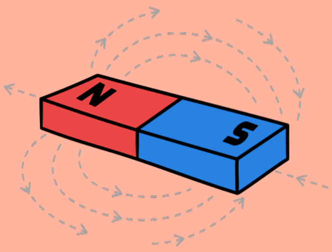
Students explore magnetism by testing materials, discovering attraction and repulsion, and completing a magnet maze challenge.

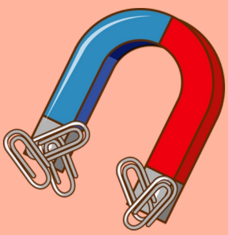
45 - 60 min **Duration**

Recommended age for this game **6-9 years old**



Learning Objectives





- Understand what magnetism is and identify objects that are magnetic and non-magnetic.
- Describe how magnets work, including the concepts of attraction and repulsion.

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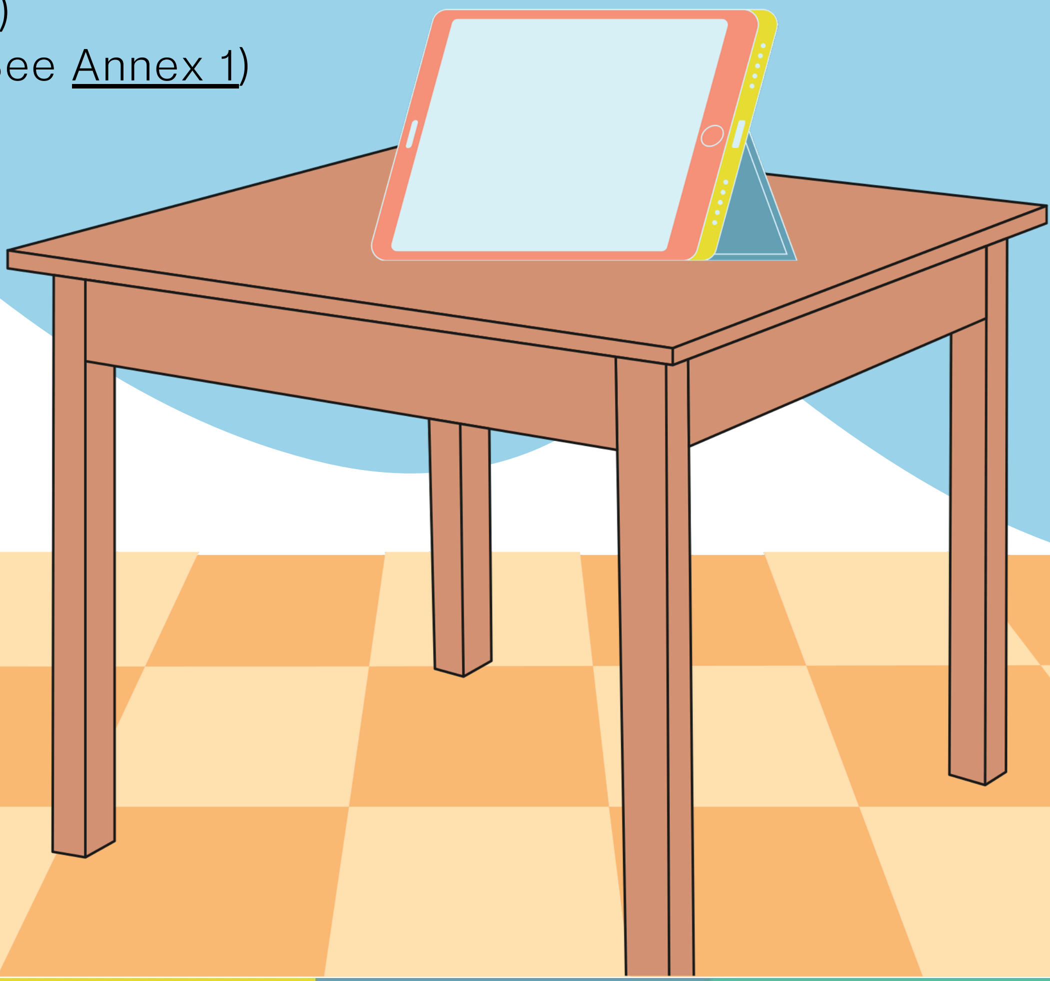
Materials and tools needed

- Various magnets (bar magnets, horseshoe magnets, ring magnets)
- Small objects to test (paper clips, coins, rubber bands, plastic pieces, aluminum foil) Magnetic vs. Non-Magnetic Sorting Chart (worksheet - see references).
- Pre-made magnet maze templates (printed sheets with paths for moving an object - see references)
- Small metal object (like a paperclip) to move through the maze
- Tape to secure mazes to desks
- Digital tool: PhET 'Magnets and Electromagnets' simulation (see references)
- Kahoot! Quiz (See Annex 1)



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Guidance for Teachers

Activity description

1. Introduction and Demonstration: A teacher-led discussion and demonstration of magnets in action.
2. Hands-on Experimentation: Students test different materials to see which are magnetic.
3. Magnet Maze Challenge: Students use a hidden magnet to navigate a small object through a paper maze.
4. Technology Integration: Students interact with an online simulation to visualize how magnetism works.
5. Discussion and Reflection: A group discussion to review what they learned, followed by a fun quiz (See Annex 1 for quiz questions).

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Guidance for Teachers

Preparation

- Set up materials: Arrange stations with different objects for magnet testing.
- Prepare magnet maze worksheets: Print enough copies for small groups.
- Ensure technology is ready: Open PhET simulation on tablets or computers.
- Test demonstration magnets: Have working examples of attraction and repulsion ready.
- Prepare reflection worksheets and assessment materials.

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Guidance for Teachers

Implementation steps

1. Introduction and Demonstration
    - Show different types of magnets and ask students if they have seen them before.
    - Demonstrate how magnets attract and repel each other.
    - Introduce the concept of a magnetic field.
    - Ask: "What do you think makes something magnetic?"

2. Hands-on Experimentation
    - Distribute a variety of small objects to each group.
    - Ask students to test each item using a magnet and sort them into magnetic and non-magnetic.
    - Have students record their findings on the sorting chart worksheet.

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Guidance for Teachers

Implementation steps

3. Magnet Maze Challenge
   - Distribute pre-made magnet maze worksheets.
   - Tape the maze to the desk and place a small paperclip or metal object on top.
   - Have students move the object through the maze using a hidden magnet underneath the paper.
   - Discuss: "What happens when we move the magnet closer or farther away?"

4. Technology Integration
   - Guide students to use the PhET Magnets and Electromagnets simulation.
   - Have them explore how magnetic fields interact with different materials.
   - Encourage students to experiment with different magnet strengths and placements.

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Guidance for Teachers

Implementation steps

5. Discussion and reflection
   - Ask students: "What surprised you the most?"
   - Discuss real-world applications of magnets (e.g., fridge magnets, MRI machines, compasses).
   - Conduct a Kahoot! quiz or use a printed quiz to check understanding.
   - Have students complete their reflection worksheets.

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Follow-up and reflection

1. Observation During Activities
   - Were students able to correctly identify magnetic vs. non-magnetic materials?
   - Did they successfully complete the magnet maze challenge?

2. Student Worksheets
   - Magnetic Sorting Chart (Completed with correct answers?)
   - Reflection Worksheet (Thoughtful responses to learning questions?)

3. Quiz or Kahoot!
   - Score-based evaluation to check comprehension (See Annex 1 for quiz questions).

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Student Activities

Activity description	Expected outcome	Technology integration
Magnetic Sorting Challenge	Students will understand which materials are magnetic and non-magnetic.	Use a digital worksheet or app for recording results and predictions.
Magnet Maze Challenge	Students will use magnets to navigate a metal object through a maze, exploring magnetic force.	Use a simulation tool to visualize magnetic force in action.
Interactive Quiz on Magnetism	Students will reinforce their learning through assessment and feedback.	Use an interactive quiz platform like Kahoot to test knowledge and provide feedback.
Exploring Magnetic Fields	Students will observe and understand how magnetic fields interact with objects.	Use a PhET Interactive Simulation to experiment with different magnet strengths.
Designing a Magnetic Experiment	Students will design and test their own experiment involving magnetism.	Use digital documentation tools (e.g., Google Slides, Canva) to present their experiment results.

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Reflective questions for students

- How did the magnet help you move the object through the maze?
- What happened when you tried different types of magnets?
- How do you think magnets are used in everyday life? Can you give some examples?
- If you had a stronger magnet, how do you think it would change the experiment?
- What would happen if we tried to use a magnet on water or glass? Why do you think so?

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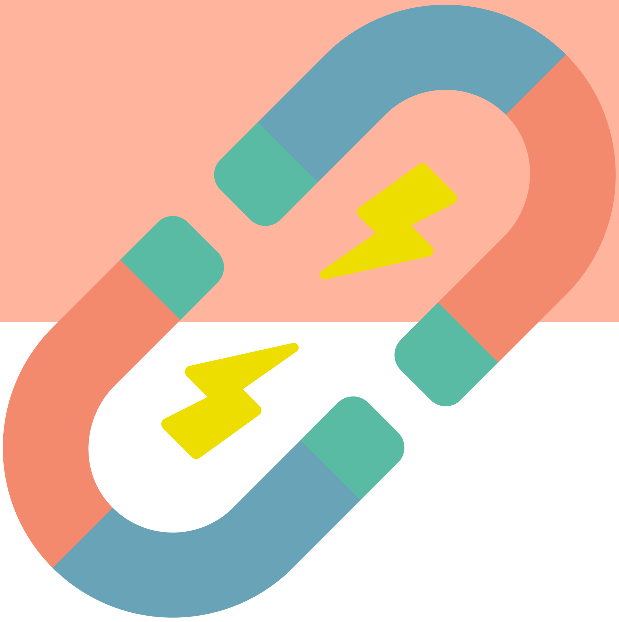
Differentiation ideas

For Advanced Learners:

- Challenge them to design their own magnet experiment (e.g., testing magnet strength at different distances).
- Introduce the concept of electromagnets and let them research how they are used in real life.

For Students Who Need Extra Support:

- Use larger, color-coded materials for easier handling.
- Pair students with a buddy for hands-on tasks.
- Provide a visual checklist to help them track their progress.



Tips Before the lesson

- Gather Materials in Advance – Ensure you have a variety of magnets, metal and non-metal objects, and magnet maze templates ready before class.
- Test Demonstrations First – Try out magnetic attraction and repulsion examples to ensure they work well for the class demonstration.
- Set Up Workstations – Organize the classroom into small groups with their own sets of materials to encourage hands-on participation.
- Check Technology – If using PhET magnet simulations or Kahoot! quizzes, test the technology beforehand to avoid disruptions.

Tips
During the lesson

- Start with a Fun Question – Ask: “Can you name something in your house that uses a magnet?” to spark curiosity.
- Encourage Predictions – Before testing objects, have students guess whether something is magnetic and explain why.
- Use Inquiry-Based Learning – Instead of just explaining, let students explore and discover why some objects attract to magnets and others don’t.
- Facilitate Group Work – Pair students so they can discuss observations, which helps reinforce learning.

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Tips
After the lesson

- Ask Open-Ended Questions – Use reflection questions like “What surprised you the most?” to get students thinking.
- Assess Understanding Creatively – Instead of just a quiz, have students draw their own magnet experiment or explain a real-world use of magnets.
- Relate to Everyday Life – Encourage students to find magnets at home (e.g., fridge magnets, toy cars, speakers) and bring examples for the next class.

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Key Takeaways

- Magnets attract and repel depending on their poles.
- Not all materials are magnetic; only certain metals (iron, nickel, cobalt) are.
- Magnets have real-world applications in technology and daily life.
- Digital simulations help visualize magnetic fields in action.

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Additional materials and references

Video: "Magnetism?"
Kahoot
PhET Magnets
Magnet Maze Printables

ANNEX 1

Questions for the quiz

1. What happens when two like poles of a magnet are brought close to each other?
A) They attract
B) They repel
C) They stick together
D) Nothing happens

2. Which of the following materials is magnetic?
A) Plastic
B) Wood
C) Iron
D) Glass

3. What do we call the invisible area around a magnet where its force can be felt?
A) Gravity field
B) Electric field
C) Magnetic field
D) Attraction zone

4. What is an example of a real-life use of magnets?
A) A refrigerator door
B) A plastic spoon
C) A paper airplane
D) A rubber band

5. What happens when you bring a magnet close to a paperclip?
A) The paperclip moves away
B) The paperclip melts
C) The paperclip is attracted to the magnet
D) The paperclip disappears

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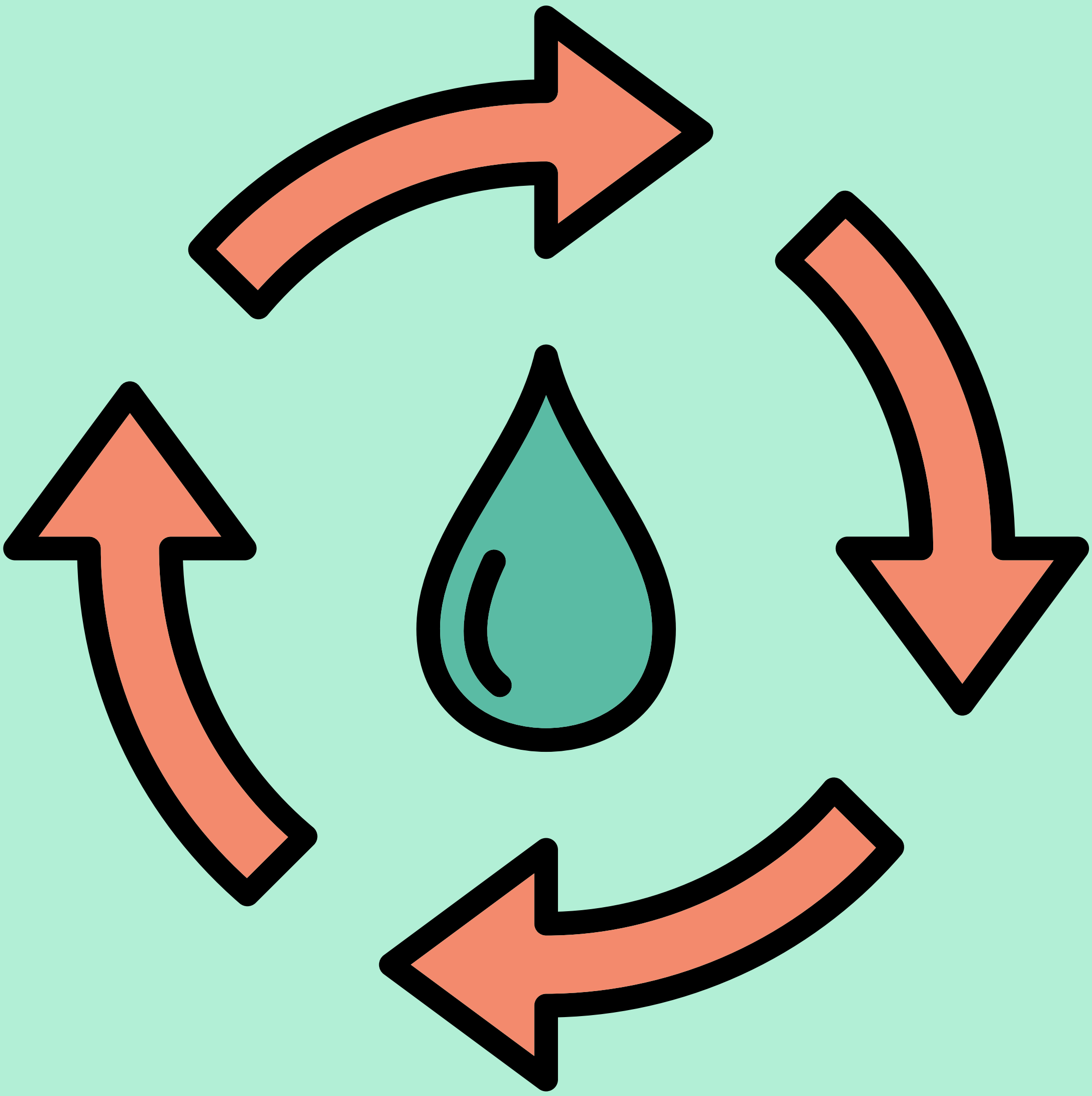
STEM in

The Water Cycle Adventure



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LESSON PLAN

The Water Cycle Adventure

Students will observe and explore the water cycle using a jar experiment to simulate evaporation, condensation, and precipitation. They will discuss real-world applications and identify key phases in a fun and interactive way.

45 - 60 min **Duration**

Recommended age for this game

6-9 years old

Learning Objectives

- Understand the four main stages of the water cycle: evaporation, condensation, precipitation, and collection.
- Observe and analyze real-world applications of the water cycle by linking it to natural phenomena (e.g., rainfall, cloud formation, puddles drying).

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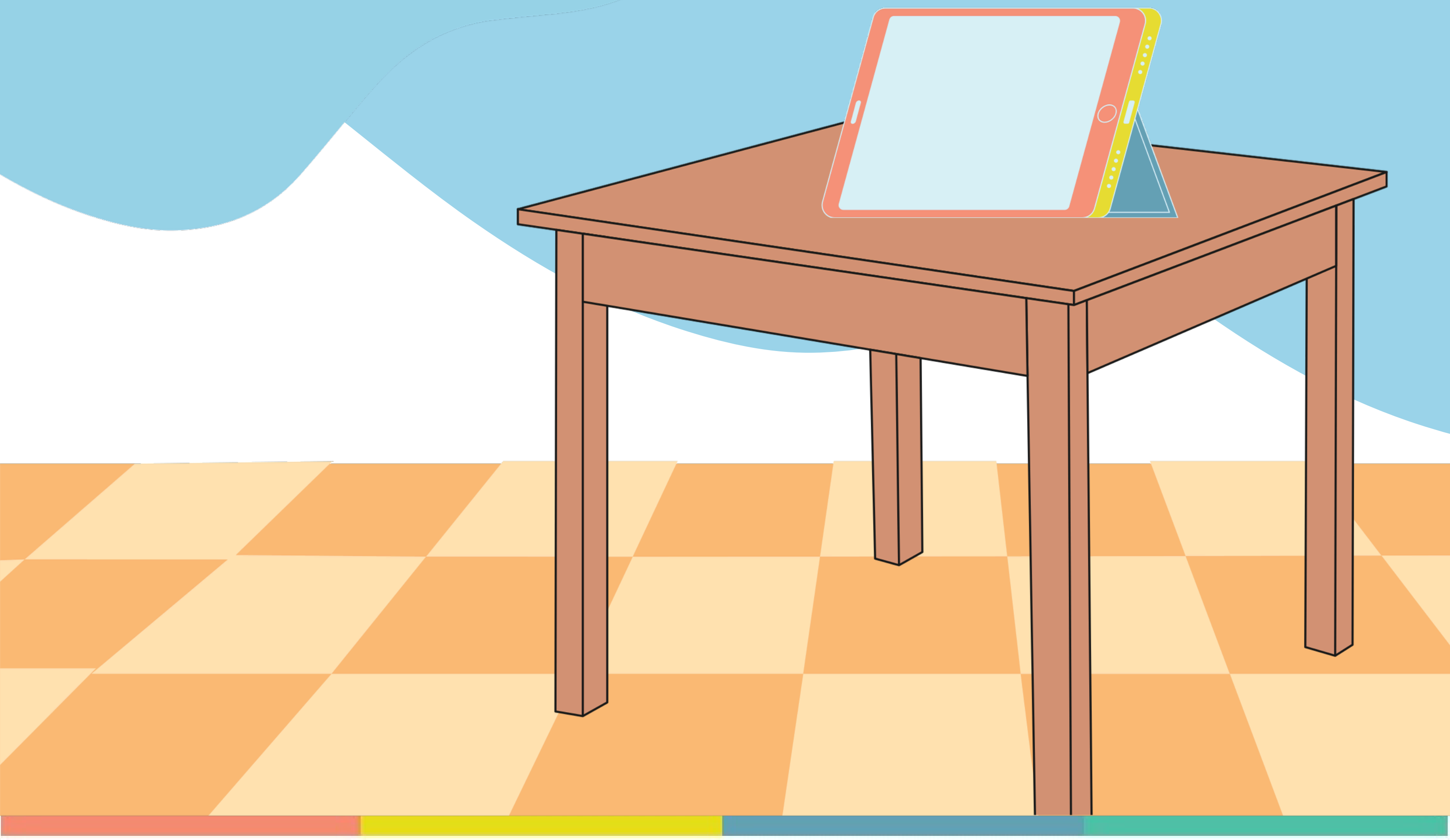
Materials and tools needed

- Warm water
- Ice cubes
- Clear jar or plastic container with a lid
- Small plate or plastic cover
- Food coloring (optional)
- Printable water cycle diagram (see <u>references</u>)



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Guidance for Teachers

Activity description

1. Introduction and demonstration: The teacher leads a discussion on the water cycle and demonstrates how evaporation, condensation, and precipitation work using a simple jar experiment.
2. Hands-on experimentation: Students conduct their own water cycle in a jar experiment, observing condensation and precipitation in action.
3. Water cycle diagram activity: Students draw and label the different stages of the water cycle on a worksheet, reinforcing their understanding.
4. Technology integration: Students watch a short animation on the water cycle to visualize how water moves through different stages in nature.
5. Discussion and reflection: A group discussion on real-world examples of the water cycle, followed by a quiz to review key concepts (See Annex 1 for quiz questions).

Guidance for Teachers

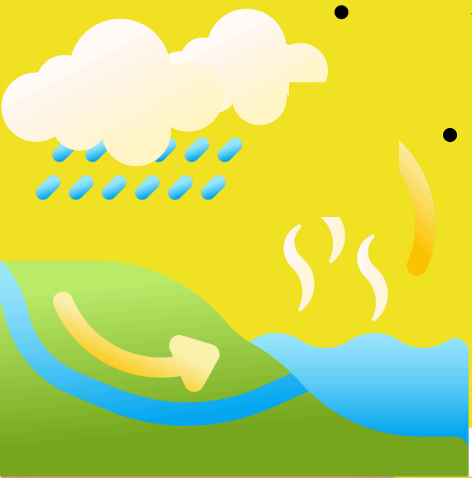
Preparation

- Gather materials and ensure all students have access to jars and water.
- Prepare a short video or simulation about the water cycle.
- Set up the classroom for hands-on experimentation.
- Create simple worksheets for students to draw and label the water cycle stages.

Implementation steps

Introduction

- Discuss where water comes from and where it goes after rain.
- Show a short animated video of the water cycle.
- Ask students to share what they already. know about rain, clouds, and water.



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Guidance for Teachers

Implementation steps

Hands-on Experiment - Water Cycle in a Jar

- Fill a clear jar with warm water (about halfway full).
- Cover the jar with a plastic plate or lid.
- Place ice cubes on top of the cover.
- Observe: After a few minutes, students will notice condensation forming inside the jar (like a cloud!).
- Discuss how warm water evaporates, cools down, and turns into condensation before falling back as precipitation.

OPTIONAL

- Add food coloring to the water to visualize movement better.

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Guidance for Teachers

Implementation steps

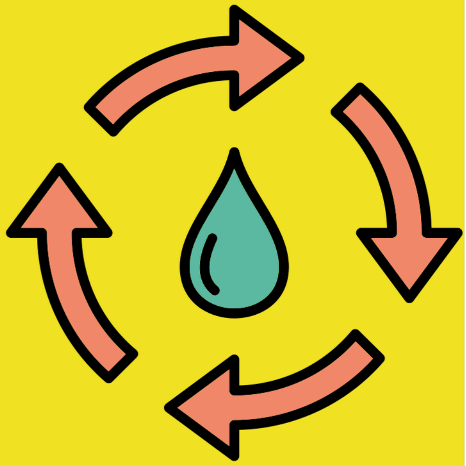
Reflection and discussion

- Ask students questions like:

???????

- **What happens when the sun shines on a lake?**
- **What happens when clouds get too heavy?**

- Have students discuss the importance of the water cycle in nature.



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Follow-up and reflection

1. Expected Outcome:
   - Students understand how the water cycle works and can explain it in their own words.
   - Students can identify the four main stages using a diagram or experiment observations.

2. Student Activities:
   - Interactive quiz: Use Kahoot! or Google Forms to check their understanding (Questions in Annex 1)
   - Draw and label their own water cycle diagram.

   - **Discussion**

- **What would happen if the water cycle stopped?**
- **Where do we see this cycle in real life?**

Student Activities

Activity description	Expected outcome	Technology integration
Create a Mini Water Cycle	Students will understand how the water cycle functions by observing evaporation, condensation, and precipitation.	Use a short educational video to illustrate water cycle stages.
Hands-on Jar Experiment	Students will see condensation and precipitation in action.	Take photos of the experiment and create a presentation.
Labeling Water Cycle Diagram	Reinforce knowledge of water cycle stages through visual learning.	Use an interactive quiz (e.g., Kahoot) to test understanding.
Discussion and Reflection	Students will articulate how the water cycle affects the environment.	Conduct a class discussion and use a digital whiteboard for brainstorming.

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Reflective questions for students

- What did you learn about the water cycle that surprised you?
- How can you apply what you learned today to real-world situations?
- Where does this happen in nature?
- What happens when a puddle disappears on a hot day?

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Differentiation ideas

For advanced students:

- Ask them to predict what would happen if the water cycle changed (e.g., what if there was no sun or no condensation?).

- **For students with special needs:** Use visual aids like large, color-coded labels and provide extra guidance in small groups.

Tips

- Adjust explanations to the students' age level by using relatable terms like "water disappearing" instead of "evaporation."
- Before the experiment, ask students what they think will happen when the warm water meets the ice.
- Allow students to take turns pouring water, placing ice, and making observations to keep them engaged.
- Relate the water cycle to everyday examples like puddles drying after rain or steam from a kettle.
- Draw or print a large water cycle diagram to reinforce the concept.
- Offer hands-on activities for kinesthetic learners, discussions for verbal learners, and videos for visual learners.
- Set clear time limits for each activity to ensure all steps are completed within the lesson.
- Guide students in discussing their observations and linking them to the water cycle stages.

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Additional materials and references

Video "The Water Cycle"
Interactive Water Cycle
Worksheets for kids to draw themselves or for teacher to print and ask to fill in
Kahoot

ANNEX 1

Questions for the quiz

1. Which stage of the water cycle happens when water changes from a liquid to a gas?

A) Condensation
B) Precipitation
C) Evaporation
D) Collection

2. What causes condensation in the water cycle?

A) The Sun heating up the water
B) Water vapor cooling down
C) Rain falling from clouds
D) Water soaking into the ground

3. What is precipitation?

A) Water turning into vapor
B) Water falling from clouds as rain, snow, or hail
C) Water collecting in lakes and oceans
D) Water moving underground

4. Where does most of the Earth's water collect?

A) Rivers
B) Lakes
C) Clouds
D) Oceans

5. What happens when the sun heats up water in a lake?

A) It turns into ice
B) It evaporates into the air
C) It forms clouds immediately
D) It disappears forever

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Mini erupting volcano

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STEM in

LESSON PLAN

Mini erupting volcano

In this activity pupils will learn about volcanic eruptions and their effects on nature and people. They will create a simple volcano model using basic materials such as baking soda, vinegar, food coloring and modeling clay.

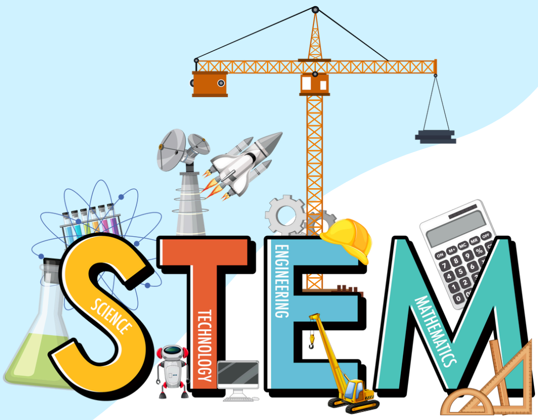
Recommended age for this game

6-9 years

45-60 min

Duration

Learning Objectives:



- Pupils will understand the process of volcanic eruptions and its effects on animals and humans.
- Pupils will create their own practical model of a volcano and calculate the time of eruption, recording its eruption.

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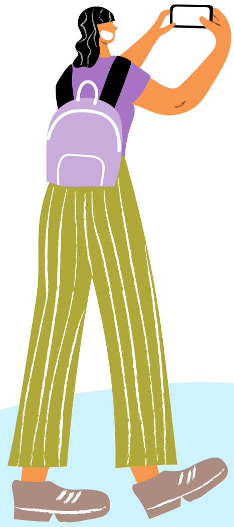
Materials and tools needed:



- baking soda;
- vinegar;
- food coloring;
- modeling clay or aluminum foil;
- plastic bottle (if you want stability, but it is not necessary);
- a tray, plate or container in which the experiment will be performed;
- mobile phone or tablet (for data recording).

Guidance for Teachers

Activity description

In this activity pupils will create a volcano using modeling clay, baking soda, vinegar and food coloring to understand how it erupts. Pupils will be able to calculate how long it takes to erupt and compare their results with their friends. They will record their eruption on video and upload it to the Padlet online platform. This activity is designed to encourage pupils' curiosity, experimentation, and application of STEM concepts using physical and digital tools.

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Preparation

- Gather materials (the amount depends on the number of pupils and whether they will work individually, in pairs or in groups): baking soda, vinegar, food coloring and plastic bottle. Ask the children to bring modeling clay.
- Prepare a presentation about a volcanic eruption (see the video in references).
- Prepare worksheets (see Annex 2 and Annex 3) and clear instructions on how to perform the experiment, take care of safety and make sure every child has the right tools.

Implementation steps

- Briefly describe and illustrate visual material about volcanoes. What they are and what their eruptions look like, what damage they can do. You can name the most famous volcanoes, for example: Vesuvius, in Italy, etc.
- Divide pupils into pairs or groups (according to their learning ability), assign responsibilities to each, and let them experience success.
- Introduce the workflow, that first the pupils will have to construct a model of the volcano, then perform and record the experiment (will add baking soda first, then mix vinegar with food coloring and prepare to pour into your crater) and finally place the recorded material on the Padlet platform (see references)
- After finishing the work, prepare for the presentation of your volcano model, self-evaluation of how well the pupils did.

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Guidance for Teachers

Technology integration

Let pupils use a digital tool like mobile phone or a tablet computer so that they record the time of the volcanic eruption and the experiment themselves. Teach children how to use the Padlet online platform (see references). Discuss any differences between the real-world and digital circuit results.

Follow-up and reflection

Interactive Quiz. Create an interactive quiz (e.g., Kahoot, Baamboozle, or similar) to test pupils understanding of the volcanic eruption STEM lesson. Questions could cover topics such as what volcanoes are, the types of volcanoes and related subjects (see Annex 1).

Assessment. Review pupils' worksheets to evaluate their understanding of volcanic processes and their reflective answers about what they've learned during the lesson.

Discussion. Ask pupils to share the challenges they faced while conducting the volcanic eruption experiment and how they overcame those challenges.

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Pupils Activities

Activity description	Expected outcome	Technology integration
Understand. Theory and videos	Pupils will understand how volcanoes work and will be able to create a functional volcano model.	Smart board, Canva program or other interactive tools for depicting volcanic eruptions
Group project: volcano model	Pupils will apply their knowledge to design a functional volcano model.	Use a mobile phone or tablet for recording experiment and sharing (e.g., Padlet platform).
Interactive Quiz about volcanoes	Pupils will reinforce their learning through assessment and feedback.	Use an interactive quiz platform like Kahoot or Baamboozle for knowledge testing and instant feedback.
Volcanoes eruptions experiment	Pupils will learn how to observe and analyze a volcano eruption and assess the duration.	Use timer tools and video recording technologies to accurately observe eruption duration.
Pupils presentations	Pupils will understand how to properly conduct an experiment and present their results.	Use video recording and editing tools to capture and share their experiment (e.g., YouTube, Padlet).

Reflective questions for pupils

- What did you learn about volcanoes today that surprised you?
- How could you apply what you learned about volcanic eruptions to a real-world situation?
- What challenges did you face while working with the materials or technology when creating the volcano model? How did you solve these challenges?
- If you were to repeat this experiment, what changes would you make to improve the results or make the experiment more interesting?
- What factors do you think most influenced the duration and intensity of your volcano models eruption?

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Differentiation ideas

- Encourage advanced pupils to research different types of volcanic eruptions (e.g., effusive vs. explosive) and their causes, then present their findings to the class.
- Challenge them to create a more complex volcano model, perhaps simulating multiple eruption types or including detailed geological layers.
- Encourage them to create a multimedia presentation, incorporating video, animation, or interactive elements to explain their findings.

For pupils with special needs:

- Provide step-by-step instructions with visual aids or simplified language to help them follow the experiment more easily.
- Offer additional hands-on support or assign a peer buddy to guide them through the experiment.
- Allow for repeated practice or breaking the experiment into smaller, manageable steps with frequent check-ins to ensure understanding.

QUICK TIPS

- Provide clear instructions.
- Demonstrate how to build a volcano before pupils begin.
- Promote teamwork among pupils.
- Walk around the classroom regularly to offer support.
- Acknowledge each pupil’s success.

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Additional materials and references

Video for kids: Volcano
How to make a clay volcano
Volcanoes: resources for teachers
Erupting volcano experiment
How to use padlet

ANNEX 1
Questions for the quiz

1.This is a volcano that may erupt at any time.

a) Domant volcano

b) Active volcano (**Correct**)

c) Extinct volcano

d) Basic volcano

2. True or false? Volcanoes only exist on land.

a) True

b) False (**Correct**)

3. What is the tallest volcano in the world?

a) Mauna Kea, U.S. (**Correct**)

b) Tambora, Indonesia

c) Etna, Italy

d) Nikko-Shirane, Japan

4. Where does the word "volcano" come from?

a) Star Trek

b) Volume

c) The god Vulcan (**Correct**)

d) From starlight

5. What kind of energy do volcanoes produce?

a) Wind energy

b) Solar energy

c) Wawe energy

d) Geothermal energy (**Correct**)

Quiz link

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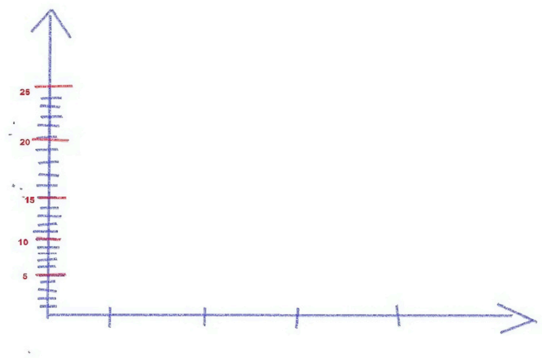
ANNEX 2

Experiment worksheet

Experiment worksheet

Row no.	Vulcanoes	Eruption path (cm)

DIAGRAM



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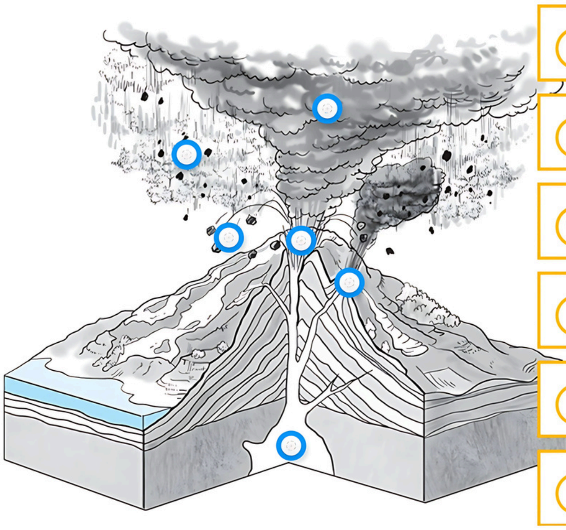
ANNEX 3

Worksheet

GROUP WORKSHEET

Names of group members:...

1. In the section diagram of the volcano, write the letters that correspond to the structure of the volcano.



- D Gas
- A Crater
- C Magma hearth
- B Lateral crater
- E Ashes
- F Volcanic bombs

2. Write in the table what benefits or harm volcanoes can cause:

BENEFIT (+)	DAMAGE (-)

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STEM in

Generation of static electricity

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STEM in

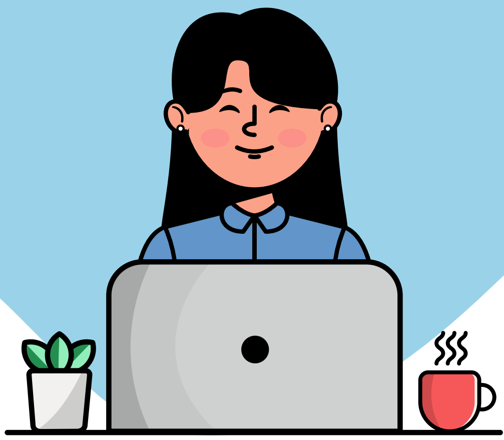
LESSON PLAN

Generation of static electricity

In this activity pupils will learn about static electricity by creating a static charge from basic materials such as a sandwich bag and a rubber balloon.

45-60 min **Duration**

Recommended age for this game **6-9 years**



Learning Objectives

- Pupils will understand what is static electricity and how it affects objects.
- Pupils will create a static electric charge between two different materials.

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Materials and tools needed

- Sandwich bag
- Rubber balloons x2
- Wool fabric
- Scissors
- Static electricity creation video material, list of concepts (see references).

Guidance for Teachers

Activity description

In this activity pupils will create a static charge using a rubber balloon and a sandwich bag to understand how static electricity works. Pupils will learn the basic components of static electricity and explore how a static charge is formed and how the discharge affects different materials or objects. They will also experiment with different configurations, such as rubbing and touching a balloon to another balloon, to their hair. These activities are designed to encourage curiosity, experimentation and the application of STEM concepts using a variety of materials and tools.

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Guidance for Teachers

Preparation

- Gather the materials: sandwich (polyethylene) bag, rubber balloons, woolen fabric, scissors.
- Prepare the worksheets for the lesson. (see Annex 2)
- Prepare a video demonstration on how to create a static electric charge and explain the basic concepts (static, charge, electrons, friction, positive, negative). (See references page)
- Prepare the classroom for hands-on experiments and ensure that each pupil has the necessary materials.

Implementation steps

- INTRODUCTION: Briefly explain what static electricity is, how its charge (friction) is created, and how different objects or materials are affected by static electricity.
- Help pupils cut a 2-3 cm (1 inch) wide strip from the sandwich bag with scissors. Explain to cut the ribbon from the top of the bag to make a loop. And the woolen cloth would be rubbed into the balloon and then rubbed into the loop of the bags belt.
- Encourage them to throw a polythene loop in the air and put a balloon under it. The loop and the balloon are affected by static electricity and affect each other. The loop hovers above the balloon.

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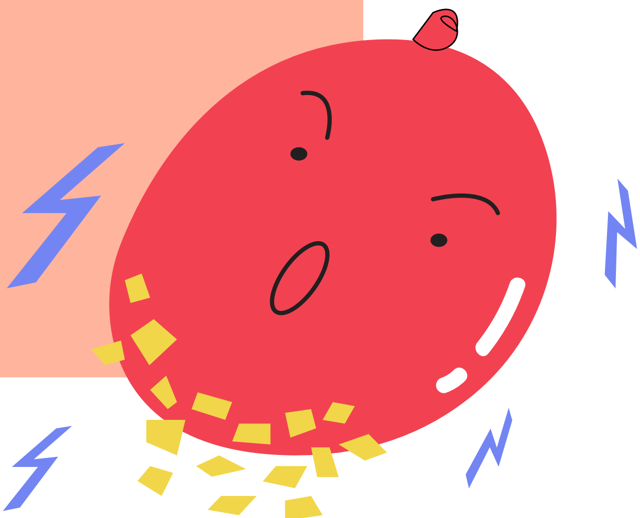
Guidance for Teachers

Discuss some real situations when we are affected by static electricity (e.g. in winter, we put on a sweater over our head - the electric discharge will explode, and our hair will fall out. When we touch metal objects, we will be affected by static electricity).

Follow-up and reflection

- Quiz: Create an interactive quiz (Kahoot) to test pupils understanding of how electricity works and related concepts (see Annex 1).
- Assessment: Review pupils worksheets to assess their understanding of how to create a static load.
- Discussions: Ask pupils to share their thoughts, observations:
  - **What surprised them**
  - **What difficulties they had?**
  - **What they did not understand?**
  - **Did the experiment work?**



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STEM in

Pupils Activities

Activity description	Expected outcome	Technology integration
Will create a static electric charge	Pupils will understand how static electricity works and be able to create it themselves.	Use PhET static electricity generation models to digitally simulate the process.
Group Project: Static Electricity Design Challenge	Pupils will apply their knowledge to create a static electricity discharge.	Use digital tools to document and present your projects (e.g. Microsoft Powerpoint, Google slides, Canva).
Interactive quiz on static electricity concepts	Pupils will consolidate their learning through assessment and feedback.	Use an interactive quiz platform like Quizizz, kahoot or Plickers.
Create a static electricity charge that affects us in real life	Pupils will test static electricity with various materials and realize that the same friction is at work on everything.	Use PhET static electricity generation models to digitally simulate the process.

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Reflective questions for pupils

- What surprised you most while developing and testing static electricity?
- What challenges did you face and how did you overcome them?
- What was the most interesting part of the “Static Electricity” experiment?
- How would you improve static electricity discharges if you had more time and materials?

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Differentiation ideas

Advanced pupils

- Ask advanced pupils to create a static electricity chain reaction, for example, by connecting several objects that emit static electricity.

Pupils with special needs

- Use simple objects to conduct the experiment so that the workflow is understandable and the result is enjoyable (e.g. brightly colored balloons, colored paper, woolen fabric, etc.).

Tips

- Provide clear instructions.
- Before pupils begin creating static electricity, demonstrate how to create it.
- Encourage teamwork among pupils.
- Walk around the classroom regularly and offer assistance.
- Acknowledge each pupil's success.

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Additional materials and references

Video: Static Charge | Electricity | Physics

Video: The science of static electricity - Anuradha Bhagwat

Video: The Sticky Balloon Trick

ANNEX 1

Questions for the quiz

1. **Which materials are needed for the static electricity experiment?**

a. Water, salt, pepper.
b. A balloon, a sandwich bag, woolen fabric (correct)
c. A pencil, a notebook, a ball

2. **What happens when you rub your hair with a balloon?**

a. The balloon expands
b. The balloon explodes
c. The hair will rise and move towards the balloon (correct)

3. **What is static electricity?**

a. The flickering of lights
b. When opposite electrical charges attract one another (correct)
c. A light pole

4. **What happens when a possitive and negative charges come in contact with each other?**

a. The opposite charges attract each other (correct)
b. The opposite charges repel each other
c. Nothing happens

5. **What happens when you negatively charge the balloon and the sandwich bag strip**

a. The balloon pushes the strip (correct)
b. The balloon attracts the strip
c. Nothing happens

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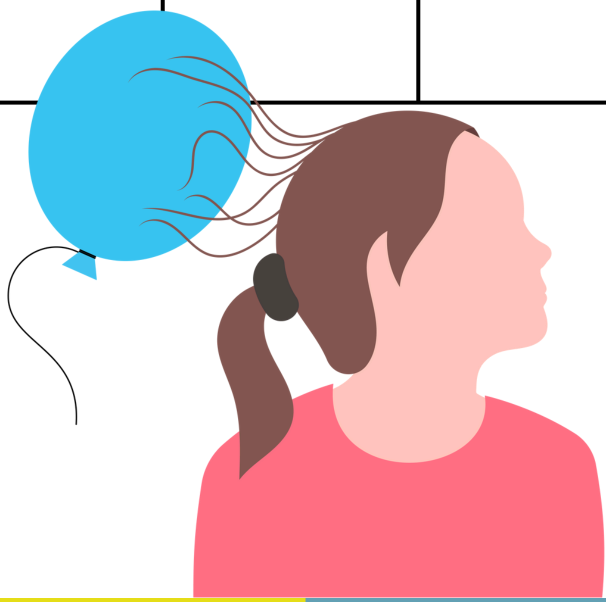
ANNEX 2

Worksheet

Useful word explanation

- Static electricity - the result of an imbalance between negative and positive charges in an object
- Atom - the smallest unit of matter
- Proton - a small particle, which has a positive charge.
- Electron - a small particle, which has a negative charge.
- Neutron - a small particle, which has no charge

No.	The name of the experiment	The supplies used	The function being performed	What happened? CONCLUSION



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STEM in

Experiment Soluble-insoluble

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STEM in

LESSON PLAN

Experiment "Soluble-insoluble"

In this activity students will learn about substances and their solubility in water, especially, which substances dissolve in water and which do not.

45-60 min Duration

Recommended age for this game

6-9 years

Learning Objectives

- Students will understand why some substances do not dissolve in water and what happens to those that do dissolve.
- Students do an experiment on the solubility of substances.

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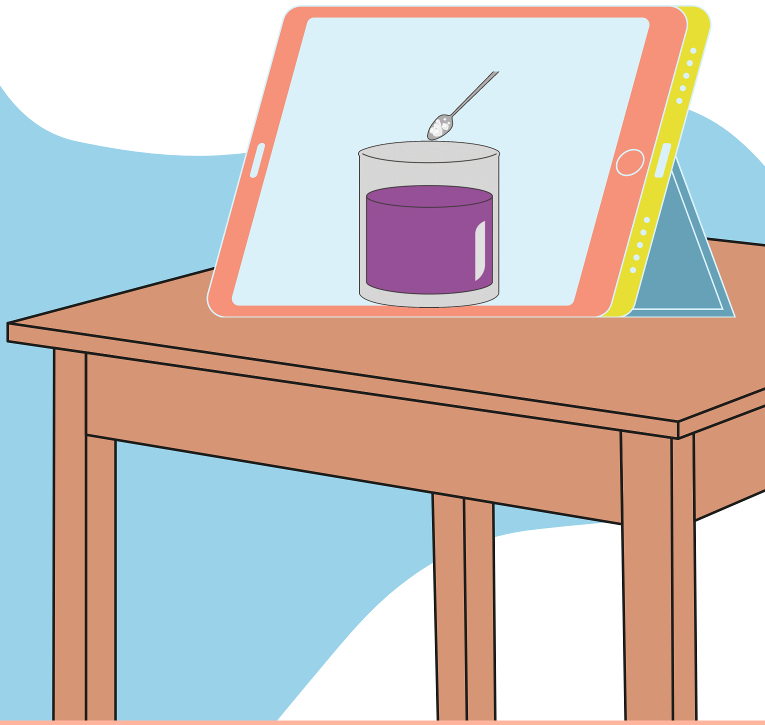
Materials and tools needed

- 7 plastic containers
- Water
- A handful of sand, salt, sugar, ground coffee, instant coffee, rice, and honey.
- A spoon.
- Other materials (e.g. toothpaste, laundry detergent or citric acid.)



Guidance for Teachers

Activity description

By completing this task, students will use 7 containers with water and selected substances to determine which of them dissolve in water and which do not. Students will find out that different substances dissolve in water differently. They can also experiment with various other materials, such as toothpaste, laundry detergent, and citric acid. This activity is designed to foster curiosity, encourage experimentation, and apply STEM concepts using a variety of materials and tools.

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Guidance for Teachers

Preparation

- 7 plastic containers
- Prepare a demonstration on how certain substances dissolve in water, which ones do not, and what happens. (See video in references)
- Prepare the class for hands-on experiments and make sure each student has the necessary materials.

Implementation steps

INTRO:

- Briefly explain what is the solubility of substances.
- Help students prepare the water containers and materials for the experiment. Explain how the experiment will be done.
- Encourage them to observe other selected substances and their solubility in water.

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Guidance for Teachers

Discuss the situations when we encounter these substances in reality and why it is important to know their solubility properties in water.

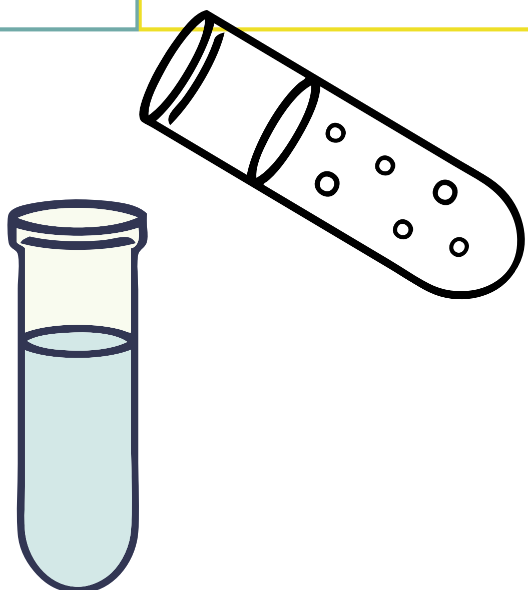
Follow-up and reflection

- Quiz: Create an interactive quiz (e.g., "Kahoot") to test students' understanding of the concepts of "Soluble-Insoluble." (see Annex 1)
- Evaluation: Review the experiments completed by students to assess whether the students understood the solubility of substances in water.
- Discussion: Ask students to share their thoughts, observations:

- **What surprised them?**
- **What difficulties they had?**
- **What they did not understand?**
- **Was the experiment successful?**

Student Activities

Activity description	Expected outcome	Technology integration
Experiment "Soluble-insoluble"	Students will understand how some substances dissolve and others do not dissolve in water.	Use the necessary and appropriate tools to do the experiment.
Group project: “Solvent-non-solubility” challenge	Students will apply their knowledge to conduct a water solubility test.	Use digital tools to document and present your experiments (e.g. Microsoft Powerpoint, Google slides, Canva).
Interactive quiz on the solubility of substances in water	Students will consolidate their learning through assessment and feedback.	Use the interactive quiz platform “Kahoot”.
Do the "Soluble-Insoluble" experiment with the materials we use in everyday life	Students will test other materials and understand which ones dissolve and which ones don't.	Use models to determine solubility so the experiment can be done in the classroom.



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Reflective questions for students

- What did you learn about experiment "Soluble-insoluble" that surprised you?
- What challenges did you face and how did you solve them?
- What was the most interesting thing you’ve learned during this experiment?
- How would you improve your experiment if you had more time and materials?

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STEM in

Differentiation ideas

Advanced students

- Ask advanced students to create data tables, for example, to list the time it took for a substance to dissolve.

Students with special needs

- Use tactile tools to test the process so that the process is understandable and the result is enjoyable.

Tips

- Provide clear instructions
- Before students begin the experiment, introduce them to safe behavior during it and provide some examples.
- Promote teamwork among the students
- Walk around the classroom regularly to offer your support
- Acknowledge each student's success

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Additional materials and references

Video: Why Does Water Dissolve Sugar?
Video: Absorption and dissolving with sugar cubes in water experiment
Interactive game: Soluble or insoluble?
Video: How Solubility and Dissolving Work

ANNEX 1
Questions for the quiz

1.Does sugar dissolve in water?

- Yes (correct answer)
- No

2. If you put rice in water, will it magically disappear or stay floating/swelling?

- It will disappear
- It will stay (correct answer)

3. Does rice dissolve in water?

- Yes (correct answer)
- No

4. What happens when you mix honey with water?

- It disappears completely (correct answer)
- It sinks but doesn't mix

5. What material is insoluble in water?

- Salt
- Flour
- Plastic (correct answer)

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For 10-12 years old students

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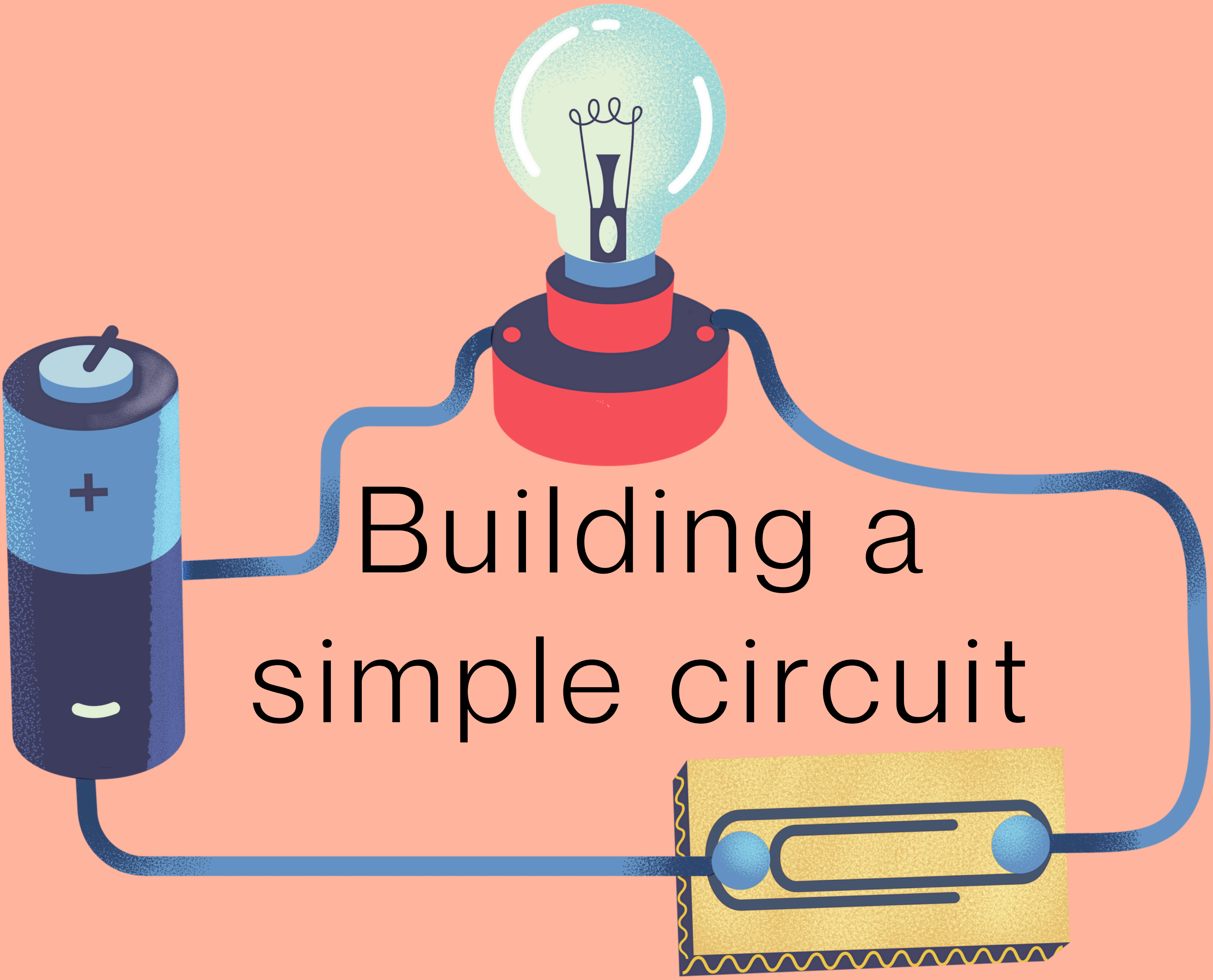
STEM in

Building a simple circuit



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STEM in

LESSON PLAN

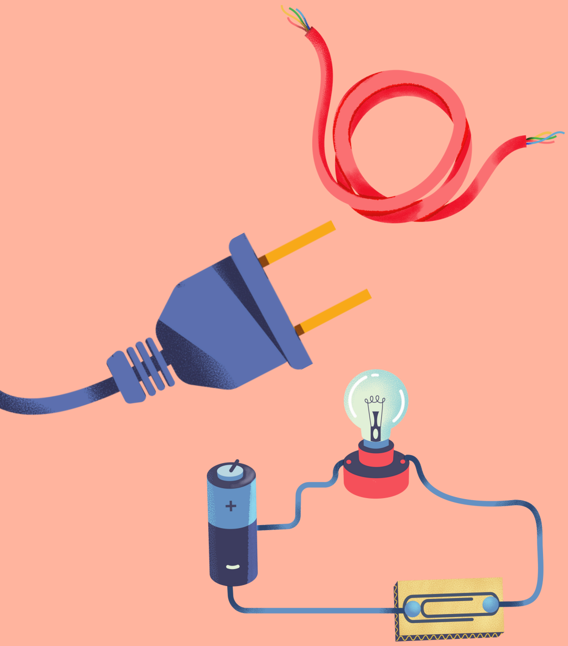
Building a simple circuit

In this activity, students will learn about electrical circuits by building a simple circuit using basic materials such as a battery, wires, and a light bulb.

45-60 min **Duration**

Recommended age for this game **10-12 years**

Learning Objectives



- Students will understand the concept of an electric circuit and how electricity flows through a circuit.
- Students will build a simple circuit using a battery, wires, and a light bulb.

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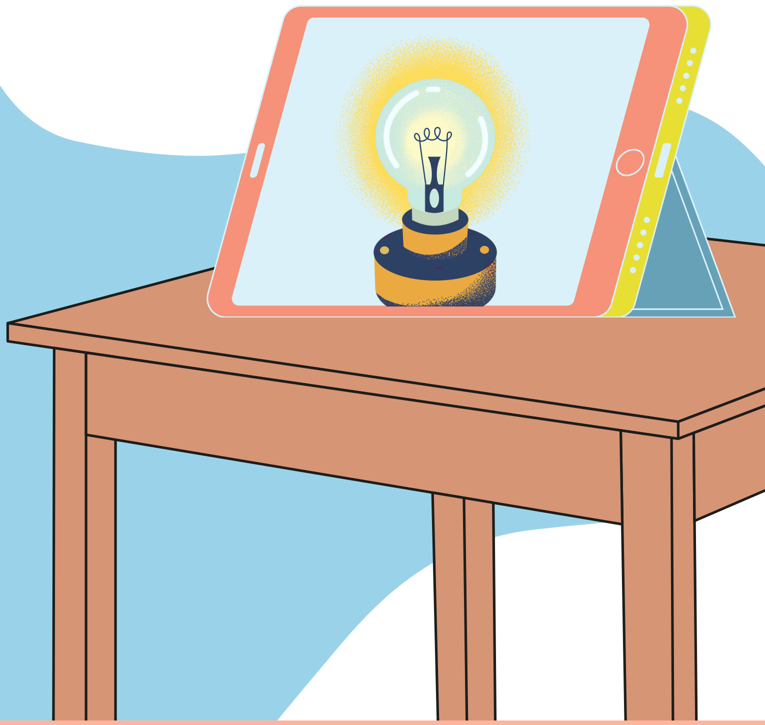
Materials and tools needed

- 1 AA Battery per student
- Battery holder (optional)
- 1 small light bulb per student
- Electrical wires (with clips)
- Electrical tape (if necessary)
- Circuit-building app



Guidance for Teachers

Activity description

In this hands-on activity, students will build a simple electric circuit using a battery, wires, and a light bulb to understand how electricity flows. They will learn the basic components of a circuit and explore how connecting them correctly powers a light. Students will also experiment with different configurations, such as adding multiple bulbs in series and parallel. The activity is designed to foster curiosity, experimentation, and the application of STEM concepts through both physical and digital circuit-building tools.

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Guidance for Teachers

Preparation

- Gather materials: AA batteries, light bulbs, wires, battery holders (optional), electrical tape, and worksheets.
- Ensure students have access to digital circuit-building apps (e.g., Tinkercad Circuits) for extension activities.
- Prepare a demonstration of how to build a basic circuit and explain key concepts (battery, wires, and light bulb).
- Set up the classroom for hands-on experimentation, ensuring each student has the necessary materials.

Implementation steps

- INTRO: Briefly explain what a circuit is and introduce the key components (battery, wires, and light bulb).
- Show also a short video or diagram to illustrate how electricity flows through a circuit.
- Guide students to connect a wire from the positive end of the battery to the light bulb, then from the light bulb to the negative side of the battery.
- Have students test their circuit by ensuring the light bulb lights up.
- EXPERIMENTATION: Encourage students to modify their circuit (e.g., add a second bulb in series or parallel). Allow time for students to troubleshoot and experiment with different configurations.

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Guidance for Teachers

- **Technology integration**: Let students use a digital tool like Tinkercad Circuits to replicate their physical circuit and observe its behavior in a simulation. Discuss any differences between the real-world and digital circuit results.

Follow-up and reflection

- Quiz: Create an interactive quiz (e.g., Kahoot) to test students' understanding of circuit concepts like series vs. parallel and the roles of each component.
- Assessment: Review students' worksheets to evaluate their understanding of circuit construction and reflective answers.
- Discussion: Ask students to share any challenges they faced during the experiment and how they overcame them.

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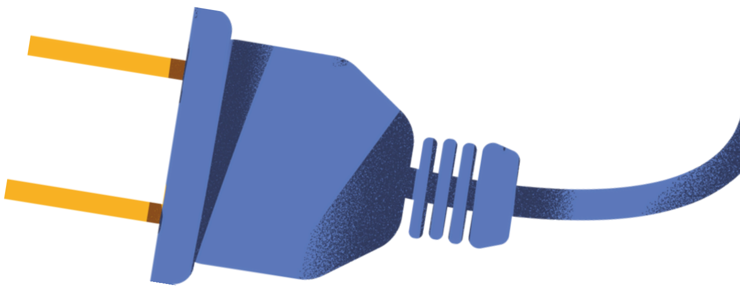
STEM in

Student Activities

Activity description	Expected outcome	Technology integration
Create a Simple Circuit	Students will understand how electrical circuits work and be able to create one on their own.	Use a circuit-building app (e.g., Tinkercad Circuits) to simulate the process digitally.
Group Project: Circuit Design Challenge	Students will apply their knowledge to design a functional circuit.	Use digital tools to document and present their designs (e.g., Google Slides, Canva).
Interactive Quiz on Circuit Concepts	Students will reinforce their learning through assessment and feedback.	Use an interactive quiz platform like Kahoot to test knowledge and provide instant feedback.
Build a Parallel Circuit	Students will learn how to create a parallel circuit and understand its behavior.	Use a digital simulation tool (e.g., PhET Interactive Simulations) to test parallel circuit designs.
Design a Simple Switch	Students will understand how a switch works in controlling the flow of electricity.	Create a digital model of a switch and simulate its operation using an online tool like Tinkercad Circuits.



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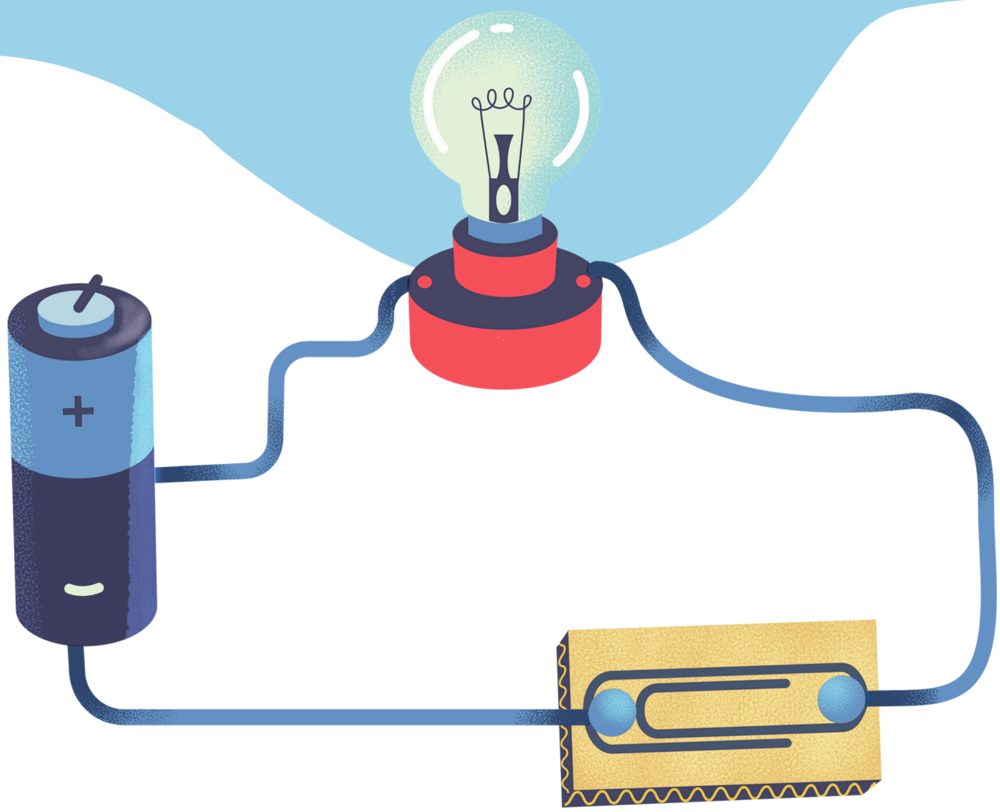
Reflective questions for students

- What did you learn about how electricity flows through a circuit that surprised you?
- What challenges did you face and how did you solve them?
- What was the most interesting thing you learned about circuits during this activity?
- How would you improve your circuit if you had more time and materials?



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Differentiation ideas

Advanced Students

- Ask advanced students to design a circuit with specific constraints, such as a circuit that includes multiple switches, LEDs, or resistors.
- Have them research real-life uses of circuits (e.g., in home wiring, electronics) and propose improvements or alternative designs.

Students with special needs

- Use large, color-coded wires and components for students with motor skill challenges.
- Provide tactile tools like snap circuits that are easy to manipulate.

Tips

- Provide clear instructions
- Demonstrate how to build a circuit before students begin
- Promote teamwork among students
- Walk around the classroom regularly to offer support
- Acknowledge each student's success

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Additional materials and references

Video: "The Power of Circuits"
Guide: Instruction of Building a Simple Circuit
Book: Creative SEL
Lesson plan: Making Circuits

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ANNEX 1
Questions for the quiz

What is needed for an electric circuit to work?

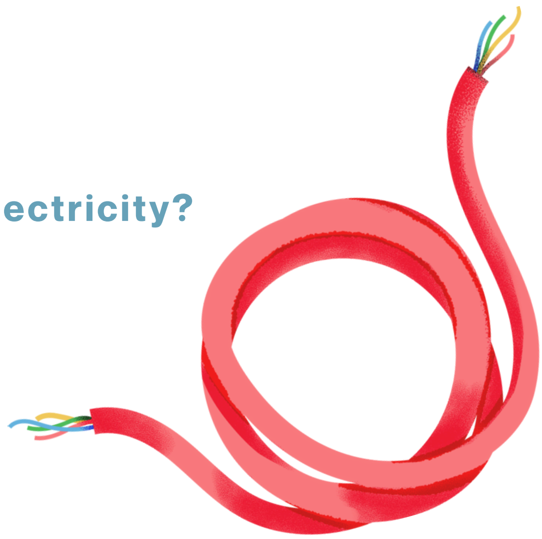
a) Only a light bulb
b) A complete path with no breaks
c) Just a battery
d) A switch

What happens if there is a break in a circuit?

a) The current keeps flowing
b) The circuit works faster
c) **The electricity stops flowing**
d) The battery loses power

Which material is a good conductor of electricity?

a) Plastic
b) Rubber
c) Copper
d) Wood



What is the role of a battery in a circuit?

a) It stops the electricity
b) It provides the energy for the circuit
c) It controls the flow of electricity
d) It changes the direction of current

What happens when you add more light bulbs to a series circuit?

a) They shine brighter
b) They turn off completely
c) They all shine dimmer
d) They explode

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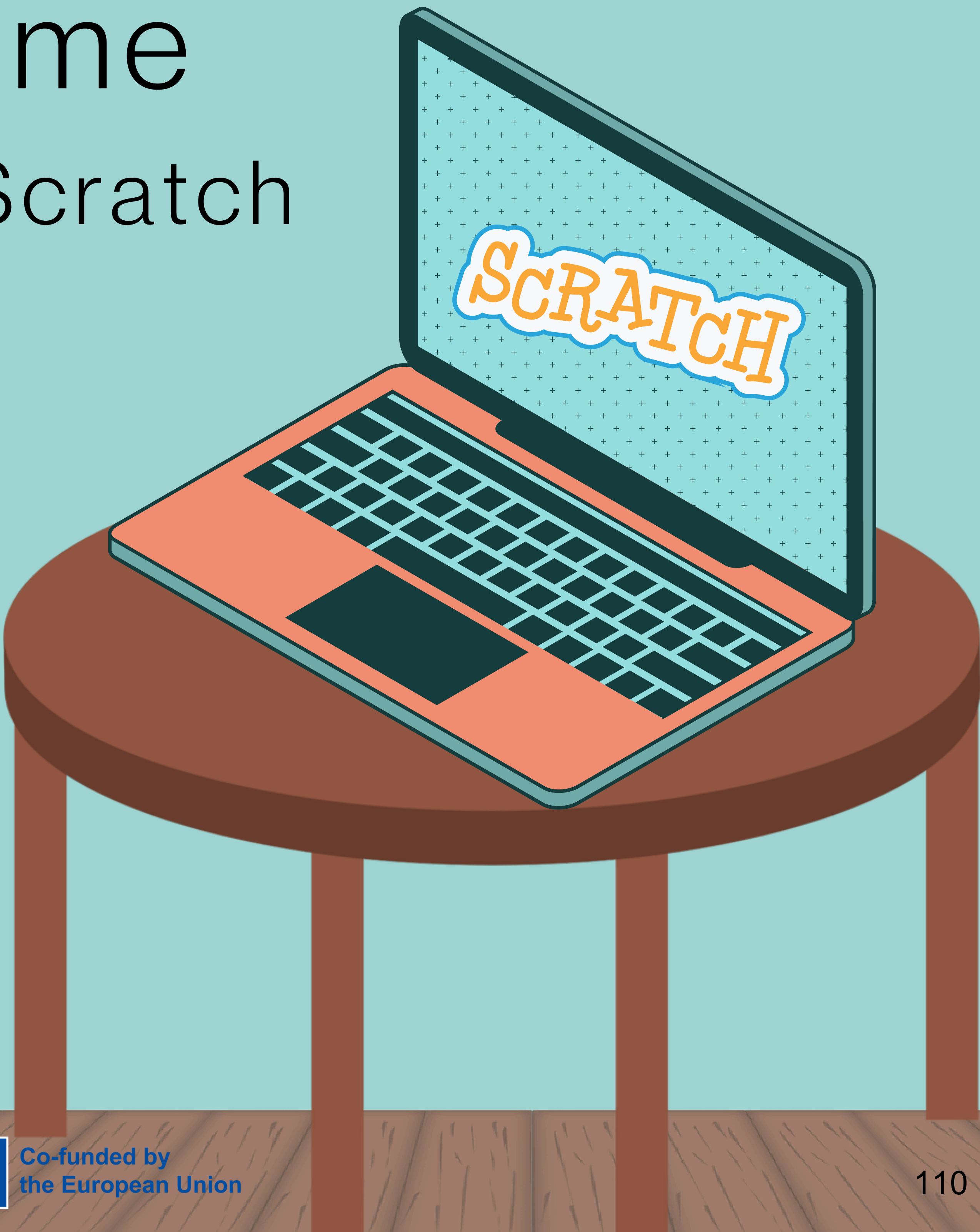
STEM in

Coding a simple game

in Scratch



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STEM in

LESSON PLAN

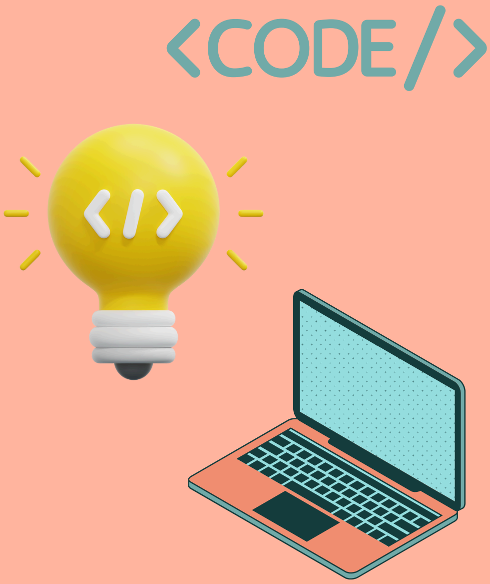
Coding a simple game in Scratch

In this activity, students will use Scratch to create a simple game, such as a maze or a character that catches objects.

45-60 min **Duration**

Recommended age for this game **10-12 years**

Learning Objectives



- Understand the basics of programming logic, including loops, sequences, and conditional statements.
- Develop problem-solving and critical thinking skills through coding.
- Create and test a functional game prototype.
- Foster creativity and collaboration in a digital environment.

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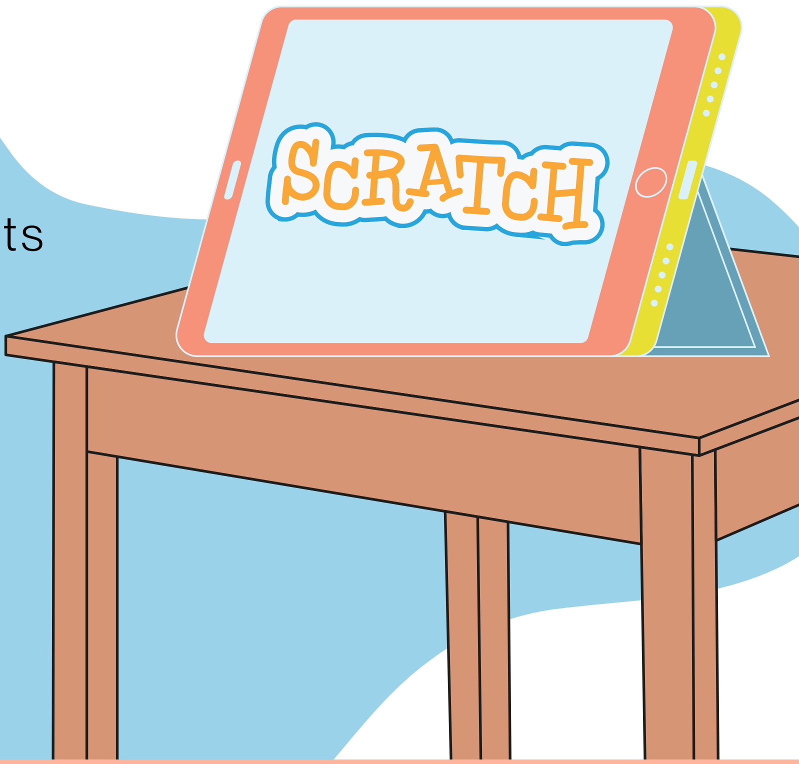
Materials and tools needed

- Computers or tablets with internet access.
- Scratch accounts for students (https://scratch.mit.edu).
- Projector or screen for teacher demonstrations.
- Headphones (optional, for game sound effects).



Guidance for Teachers

Activity description

Students will create a simple Scratch game, such as a maze or a catching game, using drag-and-drop coding blocks.

They will design the characters, set game rules, and test the game for functionality.

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Guidance for Teachers

Preparation

- Familiarize yourself with Scratch’s interface and create a simple example to demonstrate in class.
- Prepare a step-by-step guide or slideshow to introduce Scratch and the project objectives.
- Divide students into small groups if they’ll work collaboratively.
- Test all devices to ensure compatibility with Scratch.

Implementation steps

- INTRO: Explain what Scratch is and show a quick demo of a simple game (See references). Highlight also key coding blocks like motion, events, loops, and conditions.
- PLANNING: Guide students to brainstorm game ideas and sketch their designs on paper. Encourage them to define game objectives, such as winning conditions or obstacles.
- CODING: Help students set up their Scratch projects and start coding. Circulate to support troubleshooting and encourage experimentation with blocks.

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STEM in

Guidance for Teachers

- TESTING: Have students test their games, identify bugs, and improve them. Encourage peer feedback to refine their projects.
- SHOWCASE: Allow students to present their games to the class and explain their coding process.

Follow-up and reflection

- Organize a "game fair" where students play each other's games and provide feedback.
- Assign a short reflection task:

What did they enjoy?

What was challenging?

Student Activities

Activity description	Expected outcome	Technology integration
Design a Game Plan	Students will define their game’s objective, rules, and characters.	Use Scratch's "backdrop" and "sprite" options to visualize designs.
Code Game Movements	Students will program sprites to move or interact with each other.	Utilize "motion" and "event" blocks in Scratch.
Add Game Logic (Win/Loss)	Students will use conditional statements to define outcomes.	Use "if-then" and "broadcast" blocks for logic implementation.
Test and Debug	Students will identify and fix coding errors.	Debug using Scratch’s stage preview and block highlighting.
Share Game	Students will share projects and discuss their coding choices.	Use Scratch's sharing feature or class projector

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Reflective questions for students

- What challenges did you face while coding your game, and how did you overcome them?
- Which coding blocks were the most useful for creating your game?
- If you could add one new feature, what would it be and why?
- How did you use feedback from others to improve your game?
- What did you learn about teamwork or problem-solving through this activity?

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Differentiation ideas

Advanced Students

- Encourage them to add complexity, such as:
  - Multiple levels or timers.
  - Advanced logic like scoring systems.
  - Additional animations or sound effects.
- Ask themm also to assist peers who need help, reinforcing their knowledge.

Students with special needs

- Pair them with a buddy for additional support.
- Break the task into smaller steps and offer visual guides.
- Focus on celebrating progress over perfection.

Tips

- Keep instructions simple and use visuals to explain coding blocks.
- Encourage creativity by allowing students to personalize their games.
- Allocate extra time for troubleshooting and debugging.
- Foster a supportive environment where students feel comfortable asking for help.
- Use peer feedback sessions to encourage collaboration and idea-sharing.

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Additional materials and references

- Scratch Website
- Getting started with Scratch Guide
- Interactive Coding Tutorials
- Video tutorial on How to use Scratch for Kids

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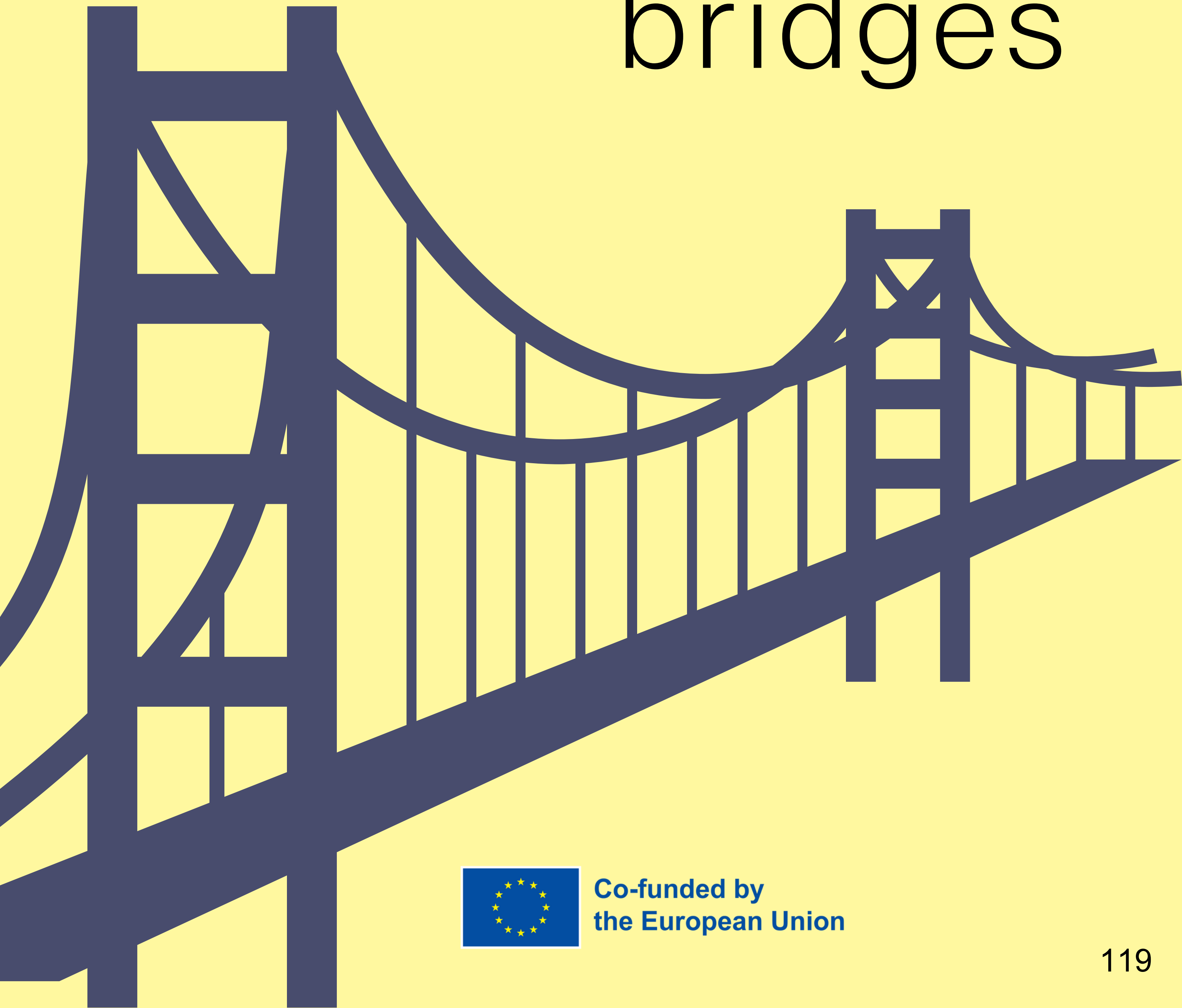
STEM in

Designing and testing paper bridges



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STEM in

LESSON PLAN

Designing and testing paper bridges

In this activity, students will build paper bridges and test how much weight they can hold by adding objects like coins.

Duration

45-60 min

Recommended age for this game

10-12 years

Learning Objectives

- Understand basic engineering concepts such as load, tension, and balance.
- Develop problem-solving skills through experimentation and testing.
- Foster creativity and teamwork in a hands-on activity.

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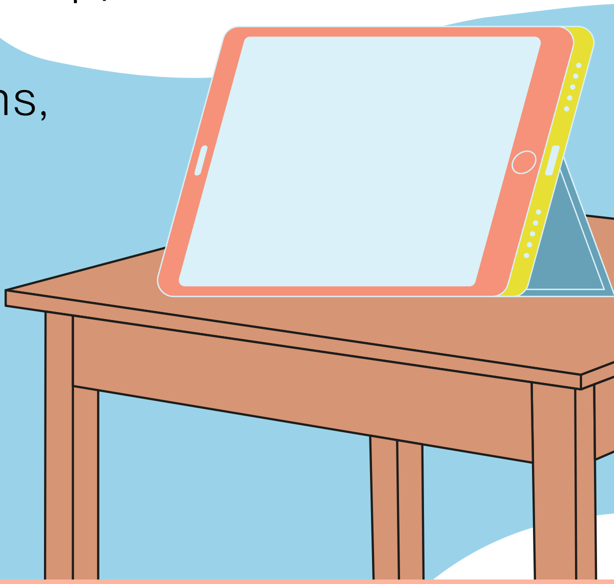
Materials and tools needed

- A4 sheets of paper (multiple per group).
- Tape and scissors.
- Small objects as weights (e.g., coins, erasers, or small toys).
- A ruler and stopwatch (optional).
- Two supports, such as stacks of books or boxes, to serve as bridge endpoints.



Guidance for Teachers

Activity description

Students will design and build paper bridges that span a gap between two supports.

They will test their bridges by adding weights to determine their strength and stability.

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Guidance for Teachers

Preparation

- Gather all necessary materials in advance and organize them into kits for each group.
- Prepare an example bridge design to demonstrate during the introduction.
- Set up the testing stations with supports and weights.

Implementation steps

- INTRO: Discuss the concept of bridges and introduce key terms like tension, compression, and load. Demonstrate also a simple paper bridge design and explain the goal of the activity: to create a bridge that holds the most weight (See references).

- DESIGN PHASE: Guide students to brainstorm designs individually or in groups. Encourage them to sketch their designs and think about how they will distribute weight.

- BUILDING PHASE: Allow students to build their bridges using only the provided materials. Provide assistance and encourage experimentation.

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Guidance for Teachers

- TESTING: Have students test their bridges by adding weights incrementally. Record results and encourage students to observe which designs are most effective.
- ITERATION: Discuss what worked, what didn't, and how designs could be improved. If time permits, allow students to rebuild and retest their bridges.

Follow-up and reflection

- Assign a task for students to research real-life bridge designs and explain how engineering principles apply.
- Discuss how lessons from this activity could apply to solving real-world problems.

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Student Activities

Activity description	Expected outcome	Technology integration
Sketch a Bridge Design	Students will plan their designs and predict their performance.	Use drawing apps or online tools like Canva to create sketches.
Build a Paper Bridge	Students will construct their bridges and refine their designs.	Document the building process using a camera or tablet.
Test the Bridge's Strength	Students will measure how much weight their bridge can hold.	Record data in a spreadsheet or use apps for weight simulation.
Observe and Evaluate	Students will analyze why certain designs were more effective.	Create a presentation of results using Google Slides or Canva.
Redesign and Improve	Students will refine their designs based on test results.	Use digital simulations or videos of real bridge construction.

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Reflective questions for students

- What part of your design made your bridge strong or weak?
- How did the weight distribution affect your bridge's performance?
- If you could use a different material, what would it be and why?
- How did testing help improve your understanding of engineering concepts?
- What challenges did you face during the design process, and how did you solve them?

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Differentiation ideas

Advanced Students

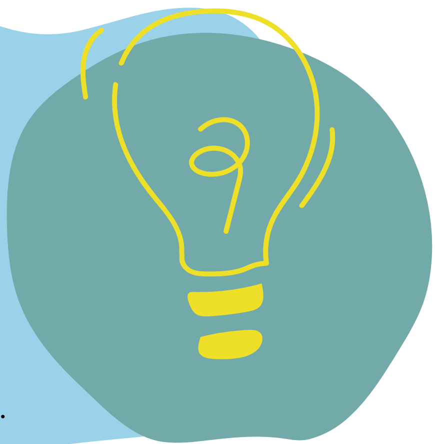
- Challenge them to incorporate arches, trusses, or other advanced bridge structures.
- Encourage them to calculate weight-to-material efficiency ratios.
- Have them research famous bridges and apply those designs to their projects.

Students with special needs

- Provide templates or pre-cut paper to simplify the building process.
- Use larger, easier-to-manipulate materials like cardstock instead of regular paper.
- Allow extra time for testing and provide one-on-one support as needed.

Tips

- Emphasize collaboration and make teamwork an integral part of the activity.
- Encourage creativity and experimentation rather than focusing solely on outcomes.
- Provide positive reinforcement for effort and innovative thinking.
- Use real-world bridge examples to inspire students.
- Ensure the testing process is fair and consistent for all groups.



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Additional materials and references

- Video How bridges are made
- Website PBS Kids' Building Big
- Books about Bridge Engineering for children
- Real-Life Example: Golden Gate Bridge
- Guide to Building Bridges With Kids

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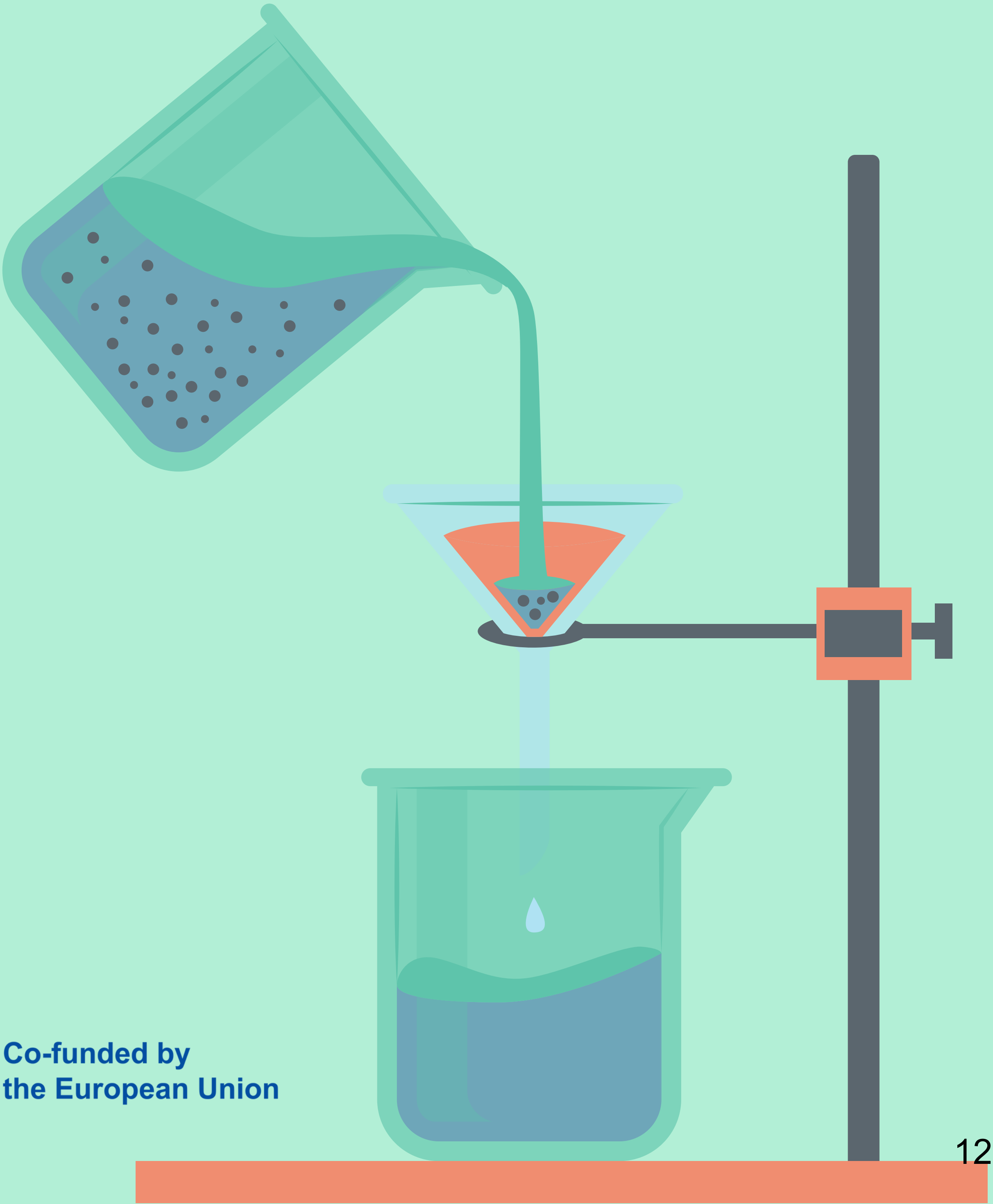
Water purification experiment



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LESSON PLAN

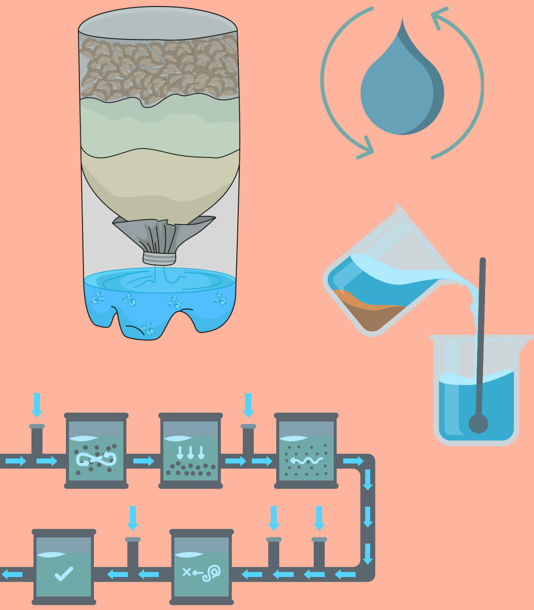
Water purification experiment

In this activity, students will create simple water filters while understanding the basics of water filtration and the importance of clean water for health and ecosystems.

45-60 min **Duration**

Recommended age for this game **10-12 years**

Learning Objectives



- Understand the concept of water filtration and its importance in providing clean drinking water.
- Learn about pollutants and how they affect water quality.
- Develop problem-solving and critical thinking skills through hands-on experimentation.

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Materials and tools needed

- Dirty water (mix soil, small pebbles, and leaves into water).
- Filter materials (cotton, coffee filters, sand, activated charcoal, gravel).
- Plastic bottles (cut in half to use as a funnel).
- Beakers or cups to collect filtered water.
- Dropper and food coloring (optional for testing).
- Worksheet for observations and results. (See Annex 1)

Guidance for Teachers

Activity description

Students will simulate a basic water purification process by designing and building their own water filters.

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Guidance for Teachers

Preparation

- Prepare sample dirty water for students.
- Set up stations with materials for filter construction.
- Provide instructions on how to layer filter materials.

Implementation steps

- INTRO: Discuss the importance of clean water and introduce terms like filtration, pollutants, and contaminants. Show also a simple demonstration of water filtration (See references).

- DESIGN PHASE: Guide students to plan how they will layer materials in their filter.

- BUILD AND TEST: Allow students to construct their water filters and test them with dirty water. Observe and compare the filtered water to the original sample.

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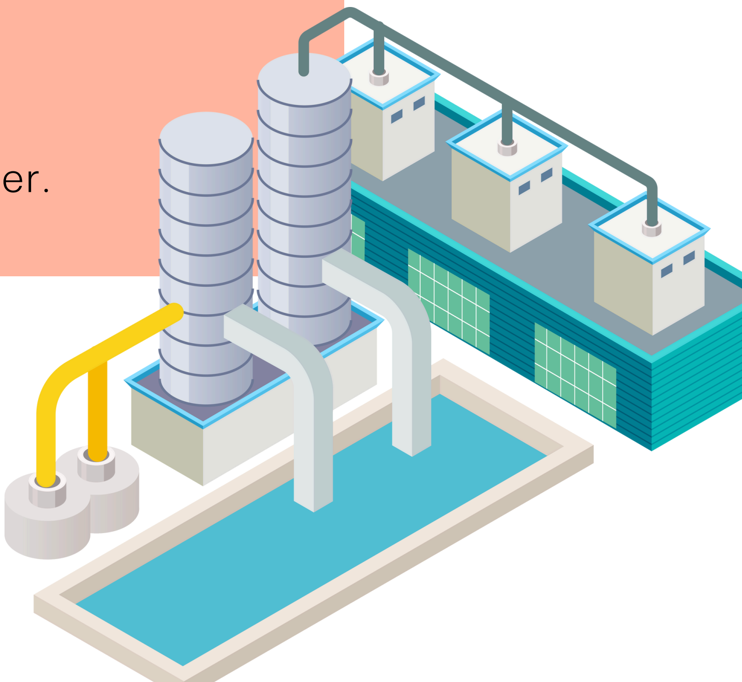
Guidance for Teachers

- OBSERVATION: Have students record their observations and discuss which materials worked best.
- REFLECTION: Discuss how this experiment relates to real-world water purification systems.

Follow-up and reflection

- Assign a research project on advanced water purification technologies, such as reverse osmosis.
- Discuss global water scarcity and solutions to provide clean water.



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Student Activities

Activity description	Expected outcome	Technology integration
Create a Water Filter	Students will design and build a basic water filter using the provided materials.	Watch a video tutorial on filtration methods
Test Water Quality	Students will test how effectively their filter cleans the water.	Use a digital microscope to observe particles in water.
Record Observations	Students will document their results and evaluate filter performance.	Input data into a digital spreadsheet or form.
Compare Filter Designs	Students will compare different designs to find the most effective combination.	Present findings using tools like Google Slides.

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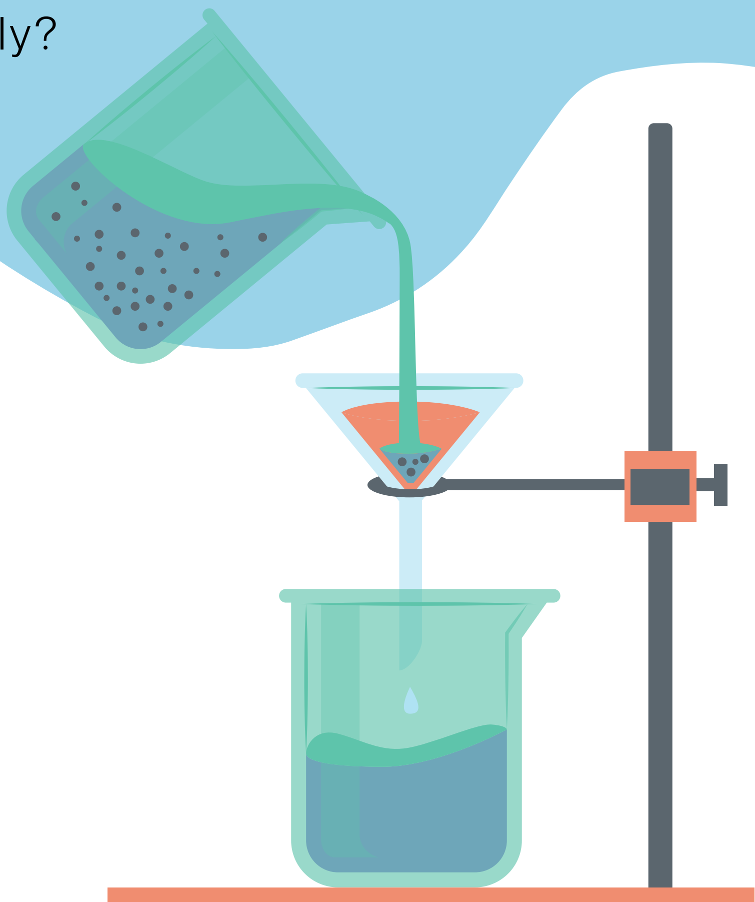
Reflective questions for students

- What materials worked best in cleaning the water and why?
- How do you think this process compares to real-life water purification methods?
- What would you change in your filter design to improve its efficiency?
- Why is access to clean water important, and what can we do to ensure it globally?



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Differentiation ideas

Advanced Students

- Ask them to research and replicate more complex filtration techniques, such as adding chemical purification steps.
- Challenge them to measure pH levels of the water before and after filtration.
- Have them create a presentation comparing filtration techniques used globally.

Students with special needs

- Provide pre-layered filters to simplify the construction process.
- Pair them with peers for collaborative support.
- Use visuals and videos to explain each step clearly.

Tips

- Emphasize the importance of observing and recording results carefully.
- Provide extra materials in case students want to try multiple designs.
- Use clear, age-appropriate explanations of filtration concepts.
- Encourage collaboration and creativity in filter designs.

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Additional materials and references

- Video: Water Filter

- Water Filtration Challenge

- Interactive website on water contamination (e.g., Explore Learning).

- Guide Make a water filter

ANNEX 1

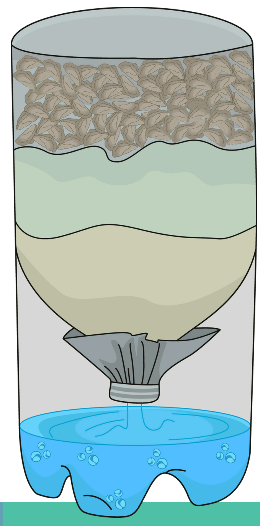
Worksheet for observation

1. Describe the appearance of the water before filtration:
(Color, clarity, any visible particles, smell, etc.)
____
____.

2. Describe the appearance of the water after each filtration step:

- First Filtration (e.g., Gravel):
  -
  -
- Second Filtration (e.g., Sand):
  -
  -
- Third Filtration (e.g., Cotton or Cloth):
  -
  -

3. Draw what you observed at each stage (before and after filtration):



Extra Challenge:
Can you think of any other ways to purify water besides filtration?

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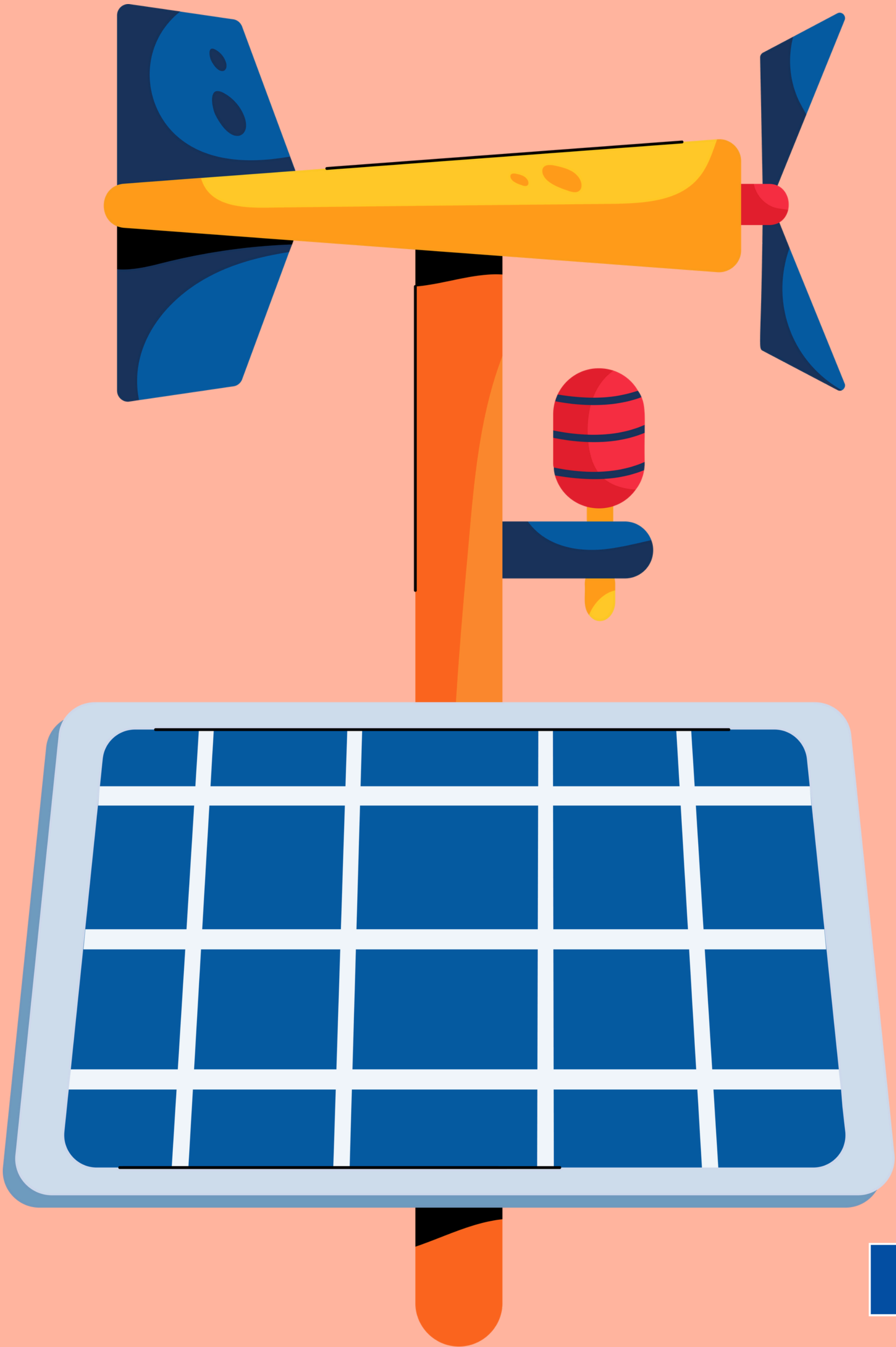
Weather station: Measure and predict



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LESSON PLAN

Weather station

In this activity, students will build simple tools like a rain gauge or anemometer and record weather patterns over a week.

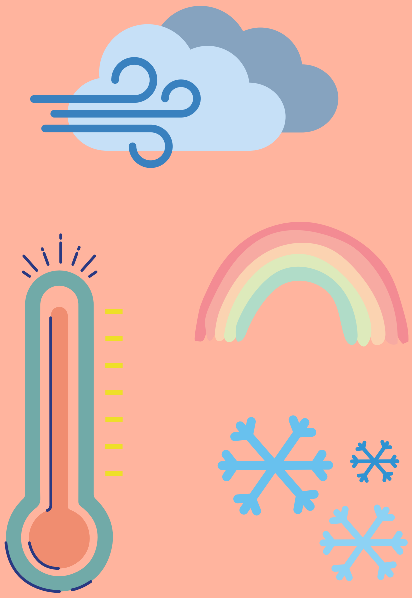
Duration

45-60 min

Recommended age for this game

10-12 years

Learning Objectives



- Understand weather patterns and how they are measured.
- Learn to use basic tools for tracking weather data (e.g., temperature, rainfall, wind).
- Develop skills to interpret and predict weather conditions.

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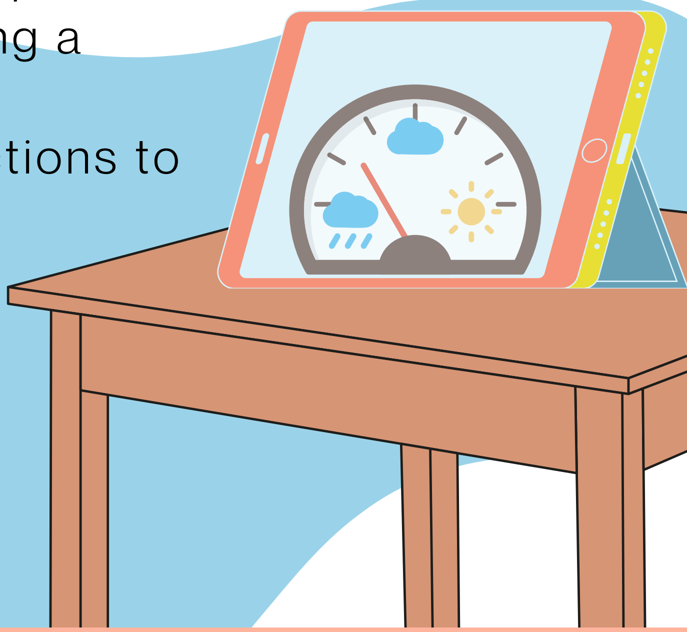
Materials and tools needed

- Thermometer (for measuring temperature).
- Rain gauge (or a DIY version using a plastic bottle).
- Anemometer (optional, or instructions to build one).
- Compass (for wind direction).
- Recording sheets or digital apps for tracking weather data (See Annex 1)



Guidance for Teachers

Activity description

Students will create a simple weather station and record daily weather data to learn about patterns and prediction.

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Guidance for Teachers

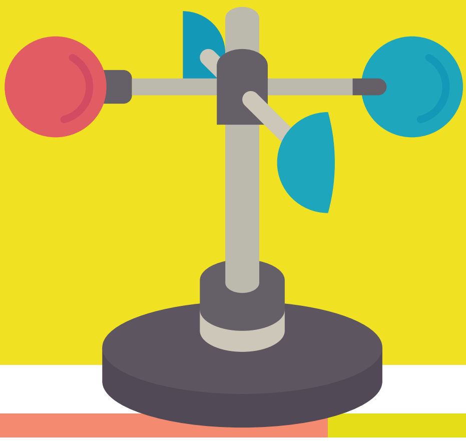
Preparation

- Collect or prepare weather measurement tools.
- Set up an outdoor space for students to place their weather station.
- Prepare templates or apps for students to record weather data (See <u>references</u>).

Implementation steps

- INTRO: Discuss the importance of weather monitoring and introduce key tools. Show also examples of professional weather stations.

- BUILDING PHASE: Guide students in building simple weather measurement tools (e.g., DIY rain gauge). Set up the weather station outside.



- DATA COLLECTION: Have students collect weather data at the same time each day. Record temperature, rainfall, and wind direction/speed.

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Guidance for Teachers

- DATA ANALYSIS AND PREDICTION: Analyze the collected data to identify patterns. Use the data to make predictions for the next day's weather.

- REFLECTION: Discuss how weather data impacts daily life and future planning.

Follow-up

- Research how meteorologists use technology to predict extreme weather.

- Discuss how climate change affects weather patterns globally.

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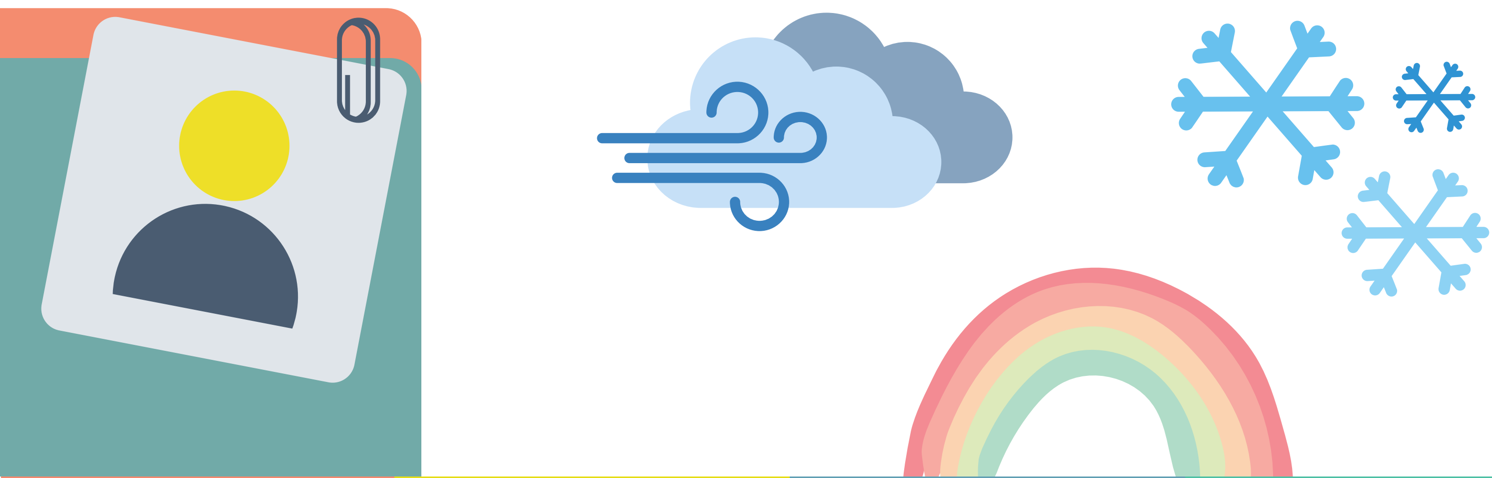
Student Activities

Activity description	Expected outcome	Technology integration
Build a Weather Station	Students will construct simple tools to measure weather variables.	Watch a tutorial on building weather tools
Record Weather Data	Students will collect and document daily weather conditions.	Use weather-tracking apps for accurate comparisons.
Analyze Weather Patterns	Students will analyze their data to identify trends and make predictions.	Plot data using Excel or Google Sheets.
Present Weather Report	Students will create a weather forecast based on their observations.	Use video tools like Canva or iMovie for reports.



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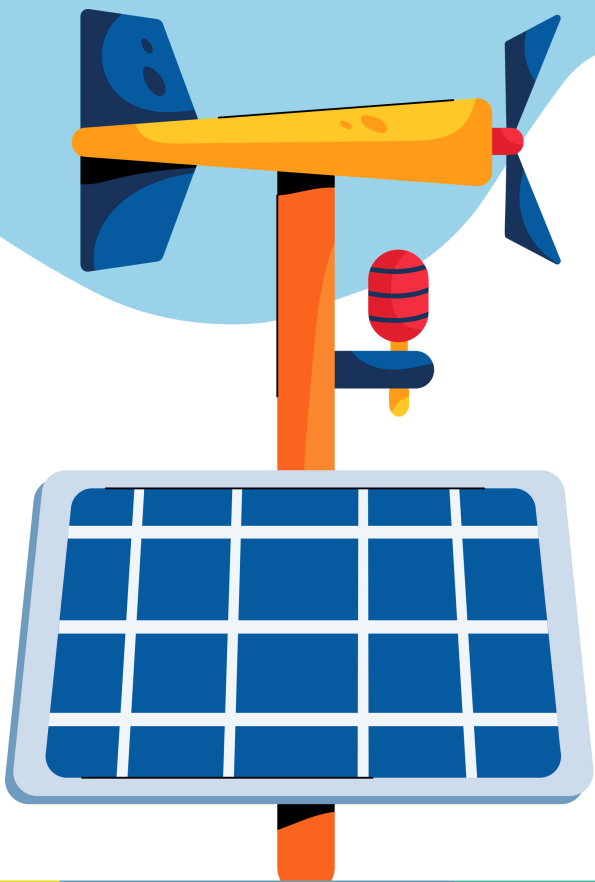
Reflective questions for students

- What weather patterns did you notice over the week?
- How accurate were your predictions?
- Why is it important to monitor weather in real-time?
- How does technology improve the accuracy of weather forecasting?



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Differentiation ideas

Advanced Students

- Challenge them to include more variables, like humidity or barometric pressure.
- Have them create a detailed weather forecast report using historical data.
- Encourage them to research global weather trends and compare them with local data.

Students with special needs

- Simplify data collection by focusing on one variable (e.g., temperature).
- Provide visual aids and hands-on guidance during setup.
- Pair them with a peer for support during the activity.

Tips

- Encourage students to be consistent with the time of data collection.
- Use age-appropriate explanations for weather concepts.
- Provide examples of professional weather reports to inspire students.
- Ensure all students actively participate, whether in setup, recording, or analysis.

Additional materials and references

- Websites: NOAA for kids or Weather Wiz Kids for fun facts and resources.
- Book: “National Geographic Kids Everything Weather” by Kathy Furgang.
- App: Weather tracking app MyRadar.
- Video: DIY weather tools

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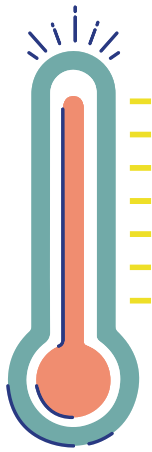
ANNEX 1

Recording sheet

Weather observations:
1. Daily weather log (add as many days as you need)

Date	Temperature (°C/°F)	Wind Speed (km/h or mph)	Cloud Cover (None, Partial, Full)	Rainfall (Yes/No)
Day 1				
Day 2				

Weather pattern analysis:
1. What was the average temperature over the 5 days? ____
2. Was there a pattern in cloud cover? Yes / No (Explain: ____
3. Did you notice any changes in wind speed over the 5 days? Yes / No (Explain: __________________________)
4. Did rainfall affect temperature changes? Yes / No (Explain: ____)



Weather Prediction:
1. Based on the data, predict tomorrow's weather:
2. Temperature: _____________°C/°F
3. Wind Speed: _____________ km/h or mph
4. Cloud Cover: (None, Partial, Full) _____________
5. Rainfall: (Yes/No) _____________
6. What clues helped you make your prediction?

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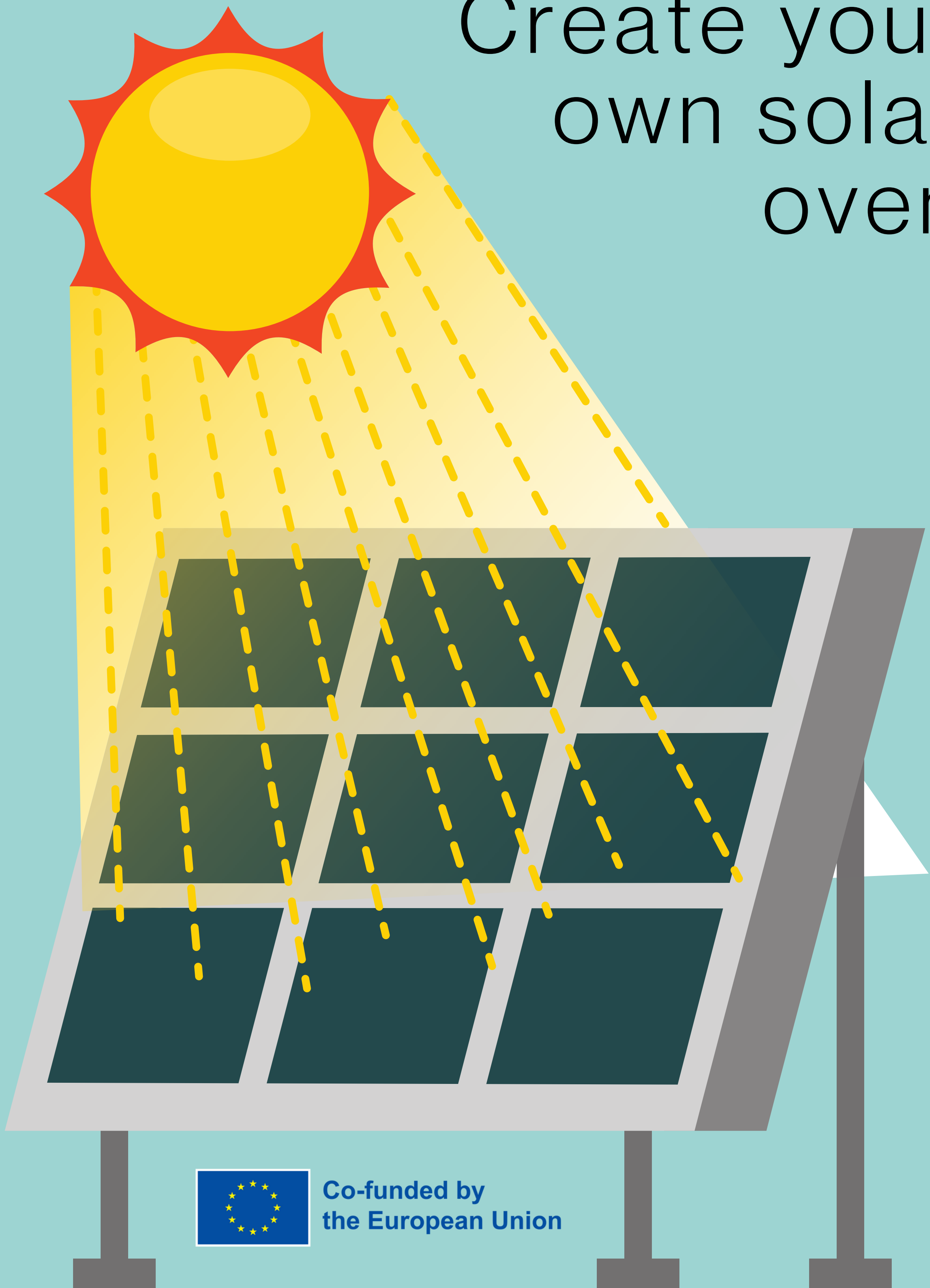
Create your own solar oven



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LESSON PLAN

Create your own solar oven

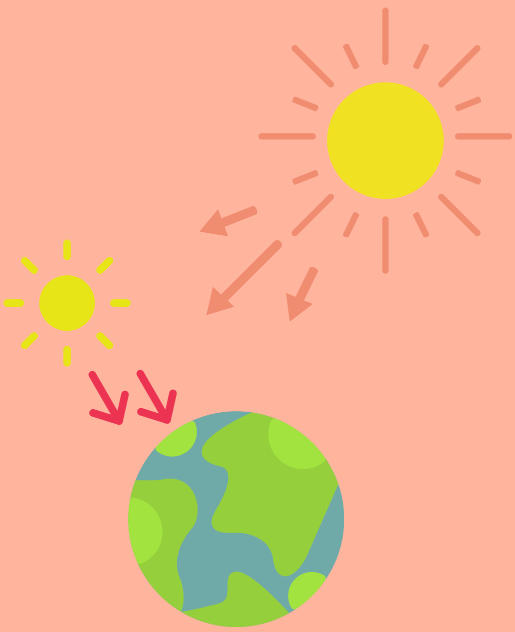
In this activity, students will design and build their own solar oven, learning how to harness solar energy and explore the greenhouse effect..

45-60 min **Duration**

Recommended age for this game

10-12 years

Learning Objectives



- Understand the greenhouse effect and how solar energy can be harnessed for cooking.
- Explore renewable energy concepts and sustainability.
- Develop problem-solving and teamwork skills by designing and building a functional solar oven.

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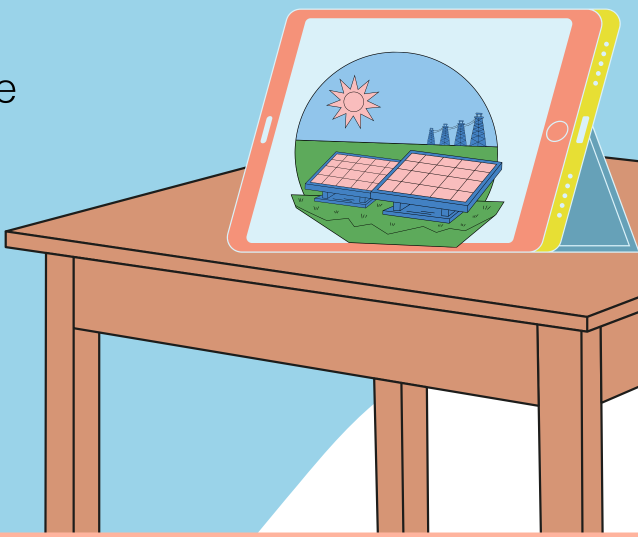
Materials and tools needed

- Large cardboard boxes (1 per group)
- Aluminum foil
- Black construction paper
- Plastic wrap or a clear plastic sheet
- Tape and glue
- Scissors or box cutters
- Ruler
- Thermometer (optional, to measure the temperature inside the oven)
- Marshmallows, chocolate, and graham crackers (to make s'mores)



Guidance for Teachers

Activity description

Students will design and build a solar oven that uses sunlight to cook or heat food, allowing them to learn about solar energy, heat absorption, and the greenhouse effect.

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Guidance for Teachers

Preparation

- Gather and prepare materials for each group.
- Create a sample solar oven to demonstrate the final product.
- Choose a sunny day for this activity or set up heat lamps for an indoor alternative.

Implementation steps

- INTRO: Discuss the greenhouse effect and the importance of renewable energy. Explain also how solar ovens work, emphasizing the concepts of reflection, absorption, and insulation.

- DESIGN AND CONSTRUCTION: Students line the inside of a cardboard box with aluminum foil (for reflection). Place black construction paper at the bottom (to absorb heat). Cover the top with plastic wrap to trap heat inside the box.

STEM in

Guidance for Teachers

- TESTING THE SOLAR OVEN:

Place marshmallows, chocolate, and graham crackers inside the oven to make s'mores.

Allow the ovens to sit in direct sunlight or under heat lamps for 15-20 minutes.

Observe and record how long it takes for the chocolate to melt or the marshmallows to soften.

Follow-up and reflection

- Discuss the effectiveness of each group's design and any adjustments they would make.
- Relate the activity to real-world solar cooking and its applications in sustainability (See additional materials)

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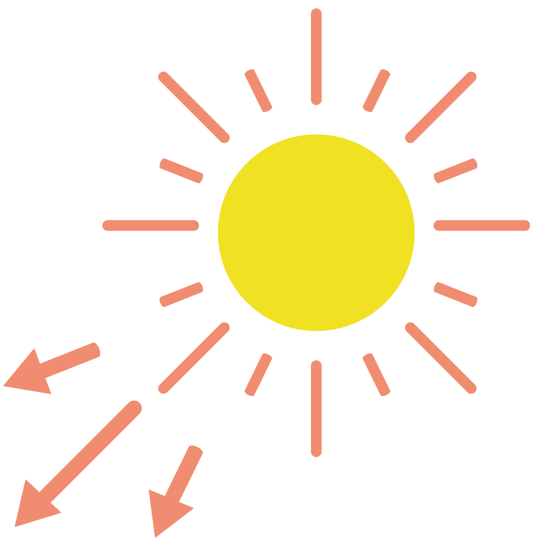
Student Activities

Activity description	Expected outcome	Technology integration
Design and build a solar oven	Students understand solar energy concepts and how heat can be harnessed.	Use design software (e.g., Tinkercad) for planning the oven.
Test the oven by cooking s’mores	Students observe heat absorption and the greenhouse effect in action.	Use a thermometer app to measure internal temperature changes.
Analyze and improve oven design	Students develop critical thinking skills by making iterative improvements.	Create a presentation using Canva to share their results.



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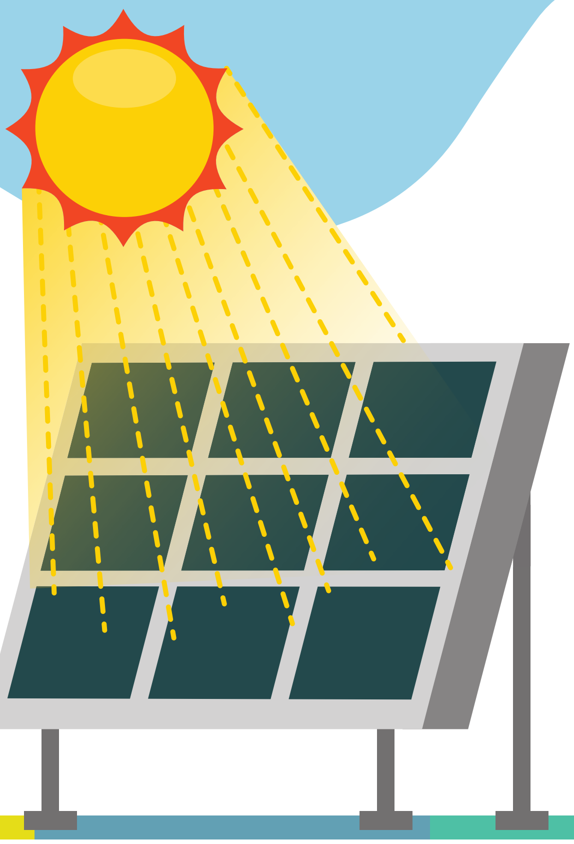
Reflective questions for students

- What worked well in your solar oven design, and why?
- How does the color of the materials affect heat absorption?
- What changes would you make to improve the efficiency of your oven?
- How can solar cooking benefit communities with limited access to electricity or fuel?



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Differentiation ideas

Advanced Students

- Challenge them to design a dual-chamber oven to cook two items at once.
- Introduce scientific measurements, like tracking temperature changes at regular intervals.

Students with special needs

- Pre-cut materials for easier assembly.
- Provide visual instructions or step-by-step guides.
- Pair them with a supportive peer for collaborative learning.

Tips

- Choose a sunny day and a clear outdoor area for testing.
- Remind students to handle materials like scissors and box cutters safely.
- Encourage teamwork and experimentation to improve designs.

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Additional materials and references

- Video How to make a homemade Solar Oven

- Blog Science Experiments for Kids-Renewable Energy

- Interactive simulation How can you cook using the Sun's energy?

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Conclusions

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CONCLUSIONS

This **STEM-IN** Lesson Plans Guide empowers you, as an educator, to make STEM learning both accessible and exciting for primary students aged 6–12. By providing clear, developmentally appropriate activities (from exploring buoyancy with floating-and-sinking experiments to designing erupting volcano models) this guide transforms abstract scientific concepts into hands-on investigations that ignite curiosity and build critical-thinking skills

By blending inquiry-based learning with real-world applications, students not only learn foundational principles in physics, chemistry, environmental science, engineering, and coding, they also develop a growth mindset, collaboration skills, and a love of discovery.

Use this guide as your roadmap: adapt activities to your classroom context, encourage student ownership of experiments, and reflect regularly on outcomes to continuously refine your practice.

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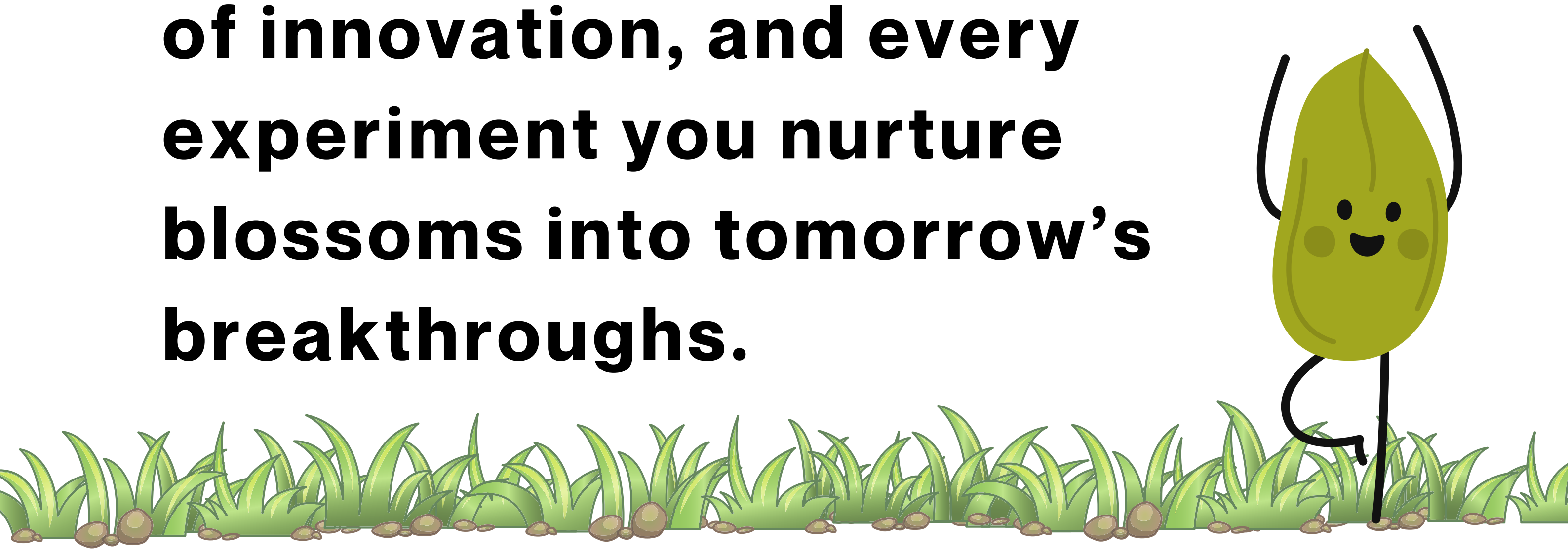
CONCLUSIONS

Ultimately, this guide is not just a collection of lessons, it is a catalyst for an immersive STEM journey where every experiment, discussion, and challenge brings learners one step closer to seeing themselves as young scientists and innovators. Embrace these resources, tailor them to your students' needs, and watch as STEM comes to life in your classroom.

Think of your classroom as a seedbed: every question you plant grows into a tree of innovation, and every experiment you nurture blossoms into tomorrow's breakthroughs.



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