**GEAR (Global and Environmental Awareness and Responsibility) – a Toolkit for Inclusive Environmental Education**

**Project Element: Water**

**TOOL: MAGIC WITH WATER!**

We organized a STEM afternoon in which students in mix-aged groups had to present the experiments they had prepared.

In order to do so each group used different sources of information to investigate easy to carry out and explain experiments. After that, they had to do the experiments, do their research and prepare the materials and documents for the public presentations.

**Objectives:**

- To present opportunities for the introduction or reinforcement of science concepts and for students to practice their science skills and to instil positive attitudes towards science studies.
- To observe, infer, discuss each groups observations, record them and report their conclussions.
- To work cooperatively in small groups and ensure everyone has sufficient opportunities to see and understand the activity

**Basic transversal competences:**

- **B.C. 08: Competence for thinking, learning and communicating:**
  - Identifying , evaluating and selecting reliable information sources.
  - Finding and recording information.
  - Understanding information and expressing what has been understood.

- **B.C. 09: Competence for initiative, entrepreneurship and communication:**
  - Planning and carrying out simple experiments, making observations and reporting their conclussions.

- **B.C. 10: Competence for learning and living and communicating together.**
  - Taking part in interpersonal, interactive situations encouraging pupils to express themselves following the rules of social behaviour.

## EXPERIMENT 1: FIRE-RESISTANT WATER BALLOON

### Objectives

- To provide students with the understanding that water (a liquid) has a higher specific heat capacity in comparison to air (a gas).
- To understand that liquids ( wáter), can absorb a large amount of energy (heat) in comparison to gas.

**Materials**: Balloons, water, candle, matches.

### Instructions:

- Inflate one balloon with air and tie off.
- Stretch the other balloon over a tap and fill with water until the balloon is approximately the size of a grapefruit.
- Light the candle and ask the class what they expect to happen when the flame touches the ‘air only’ balloon. When they have had sufficient time to consider the possible outcomes, hold the balloon in the flame – it will pop, as expected.

Let’s repeat the experiment, but this time the bottom of the balloon will have a layer of water inside.

- Show the water balloon to the class and ask whether or not they would like you to repeat the demonstration with it. They are likely become quite excited at the prospect of watching you make a terrible mess. Ask them what they expect to happen this time.
- Lower the balloon from above to ensure the flame does not touch the sides of the balloon – it will burst if this happens! Surprisingly, the balloon will not burst.

https://www.youtube.com/watch?v=JO6X6K7zRnQ

**Why doesn't the balloon pop when there is water inside?** Ask the class to think of reasons why the balloon did not burst.

When the class is sufficiently impressed by the demonstration, show them the bottom of the balloon. They will see a dark black spot which they may suspect to be a 'burnt' patch. Rub your finger across the spot to show that it is soot from the candle flame, and that the balloon is not burnt.

The secret lies in yet another amazing **property of water** – **its ability to absorve heat.**

Water is a great substance for soaking up heat. The thin latex balloon allows the heat to pass through very quickly and warm the water. As the water closest to the flame heats up, it begins to rise and cooler water replaces it at the bottom of the balloon. This cooler water then soaks up more heat and the process repeats itself. In fact, the exchange of water happens so often that it keeps the balloon from popping . . . until the heat of the flame is greater than the water's ability to conduct heat away from the thin latex and the balloon pops.

**NOTE**: The soot is wax vapour deposited onto the balloon before being entirely burnt – you can also form soot on a piece of white paper lowered onto the candle flame to explain this further

**EXPERIMENT 2: THE MAGIC BOTTLE. ANTI GRAVITY WATER TRICK**

**Objectives:**

- To understand that a substance has characteristic properties such as surface tension.
- To investigate surface tension in order to develope an understanding of properties and changes of properties in matter.

**Materials:** Piece of light flyscreen, scissors, bottle, rubber bands (2).

**Procedure:**

- Fill the bottle up with water.
- Carefully cut out a piece of flyscreen.
- Put the flyscreen over the bottle's mouth and bend the flyscreen down the neck of the bottle.
- Put a rubber band around the bottle's neck to hold the flyscreen in place.
- Turn the bottle upside down: When the bottle is completely upside down, the water stops pouring.
- Insert some toothpicks into the neck of the bottle which are clearly seen to float up through the water inside.

**SCIENCE:** Water tends to stick to itself, and this property is known as surface tension. The air can't stretch the surface of the water from a tiny flyscreen square to a huge bubble. The water molecules don't stick together particularly strongly, but it's enough to keep air out and water in.

https://youtu.be/OadVsncDRis

**EXPERIMENT 3. OIL AND WATER**

**MATERIALS**: Oil, water, a card, 2 glasses (containers), food coloring (optional)

**PROCEDURE:**

- Fill one glass to the brim with oil.
- Fill the other glass to the brim with water.
- Set the playing card over the mouth of the container filled with oil. Hold it firmly in place.
- Lift the oil container, turn it upside-down, and line it up directly over the water-filled container. Set the oil in place over the container holding the water. Keep the card between the containers to let the liquids settle. Slowly and gently remove the playing card. What happens? The oil and water remain in their respective upper and lower containers.
- Now, repeat the process (start over completely.) But, this time, turn the water container upside down and place it on top of the oil-filled container. Carefully remove the card and watch what happens. The water and oil switch places. If you wait long enough, it will look almost exactly opposite of how it started, too.

**SCIENCE**: Oil and water do **not** mix. The molecules of water can't mix with the molecules of oil. Even if you try to shake up a bottle of half-oil and half-water, the oil just breaks up into smaller droplets, but it doesn't truly mix with the water. Also, food coloring only mixes with water. It does not color the oil at all. If you see coloring in the oil, those are tiny droplets of water trapped in the oil.

When you set the water container above the oil container and remove the card, the water sinks and the oil floats. They switch places. Oil floats on the surface because water is heavier than oil. Scientists say that water is more dense than oil. This is why the oil always stays in the top container.

https://www.stevespanglerscience.com/lab/experiments/oil-and-water/

**EXPERIMENT 4: RISING WATER.**

**Objectives:**

- To demonstrate the effects of pressure and attractive forces.

**MATERIALS:** Water, a plate, a candle, a glass (a coontainer), a lighter, food coloring (optional)

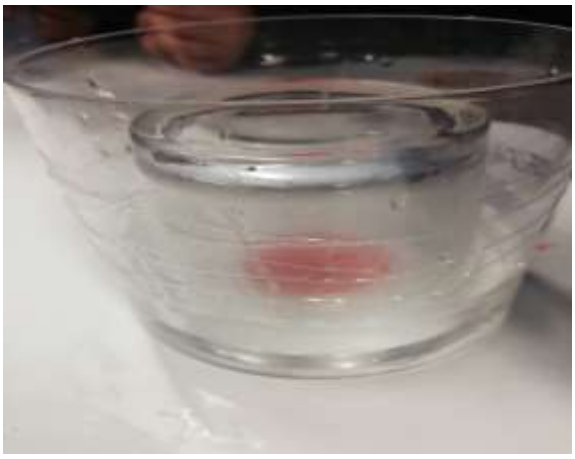
**PROCEDURE:**

- Pour the colored water in the plate.
- Place the candle in the middle of the plate, light the candle and cover it with the glass.
- Observe what happens.

**SCIENCE:**

- The candle flame will gradually diminish in size as it consumes the oxygen inside the bottle The candle goes out because it runs out of oxygen
- Heat produced by the candle's flame causes the air inside the bottle to expand – termal expansion- some of this expanding air is forced out of the bottle which can be observed as it bubbles through the water .
- When the candle flame expires, the remaining air in the bottle begins to cool – a cooling gas contracts creating a partial vacuum (a region of lower than atmospheric pressure) – the higher external pressure forces water into the bottle until the external and internal pressures are equalised (the pressure inside the bottle is lower than the pressure outside the bottle)
- The height to which the water rises depends on the shape of the bottle and the volume of the candle.

**Thermal expansion** – gases expand when heated and contract when cooled. Gases move from regions of high pressure to regions of low pressure until the pressure in both regions is equal . A vacuum is a region of lower than atmospheric pressure



https://www.youtube.com/watch?v=-g6tShHPxdA&feature=emb_logo