# Low-cost Science

SCIENCE ON STAGE 2017 DEBRECEN
THE EUROPEAN NETWORK FOR SCIENCE TEACHERS

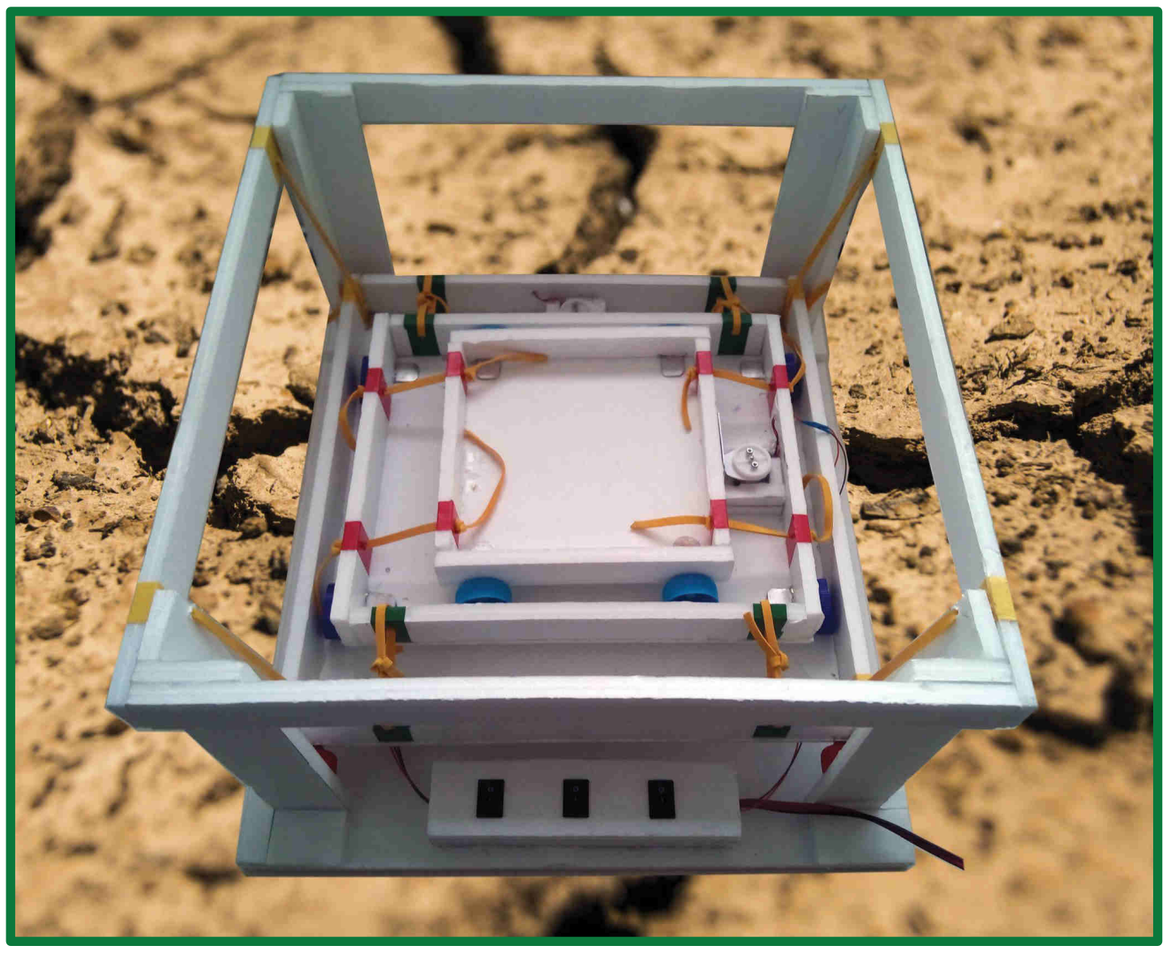
Astrinos Tsoutsoudakis | Senior High School of Gazi | Heraklion, Crete | Greece

# I. A wind turbine  II. A quake table

## (Based on upcycling and repurposing of discarded materials)

A **wind turbine** that uses four revolving cylinders **(Flettner rotors)** that form a cross, instead of blades. The rotors are spinned around their axes by four corresponding DC motors in order to exploit the **Magnus** effect. In nowadays applications the use of rotors provides better functional control over the power producing unit especially during rough weather conditions.

A **quake table** that moves along three independent axes (x, y, z) thus possessing three degrees of freedom. Various models are used to demonstrate the impact of quakes on buildings while some solutions that minimize consequences are also discussed. A **QCN sensor** (Stanford University) records acceleration data and plots it on screen in real time.



**Cheap & Fun**

Inspiration and ideas often arise seemingly out of nowhere. So do the proper materials that can come for free. Keeping a keen eye is primarily all that is needed !

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**Baiba Dage| Jelgava State gymnasium | Jelgava | Latvia**

# Engaging pupils in motion experiments

## Jet propulsion

It can be challenging to raise interest in physics among high school pupils. Competitions and active engagement in experiments and exercises is one of the best tools to motivate them.

Use accessible materials to develop simple models that every pupil can make and thus be more engaged in the process of learning physics.

| | s, m | t, s | v, m/s | a, m/s² |
|---|---|---|---|---|
| 1. | | | | |
| 2. | | | | |
| 3. | | | | |

Pupils measure distance and time of the car's journey and afterwards calculate average speed and acceleration.

By releasing the balloon air flow starts movement and thus jet motion is demonstrated.
Materials - foam plastic, plastic corks from bottles, juice boxes, straws, tape, balloons, measuring devices – timer and meter stick.

100% Great!

Results have proven that pupils appreciate such activities, engage actively and develop a better understanding of various physics themes.

"Tell me and I forget, teach me and I may remember, involve me and I learn." — Benjamin Franklin

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I. Beszeda, L. Sarka | Univ. of Nyíregyháza | Nyíregyháza | Hungary

# Do it yourself – easy to prepare demonstration tools and experiments in physics and chemistry part 1.

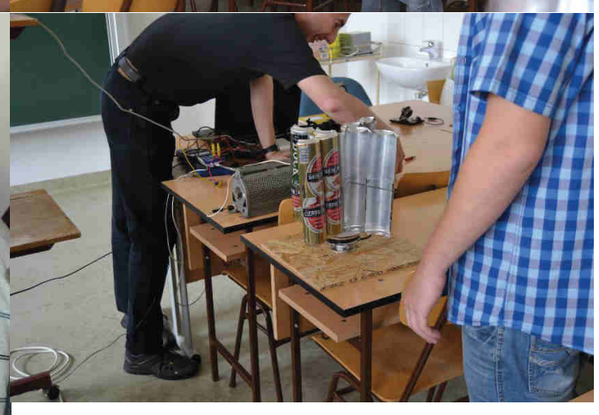
**Science popularization events:**

1. One week Summer School of Chemistry and Physics,
2. Physicists' Days in the Autumns,
3. More recently, the Researchers' Night,
4. Bródy Imre Physics Competition for schools, for ages from 13-17,
5. Special physics lectures and „show" performances, presented at our university and also in schools, summer schools, even outside our immediate region.



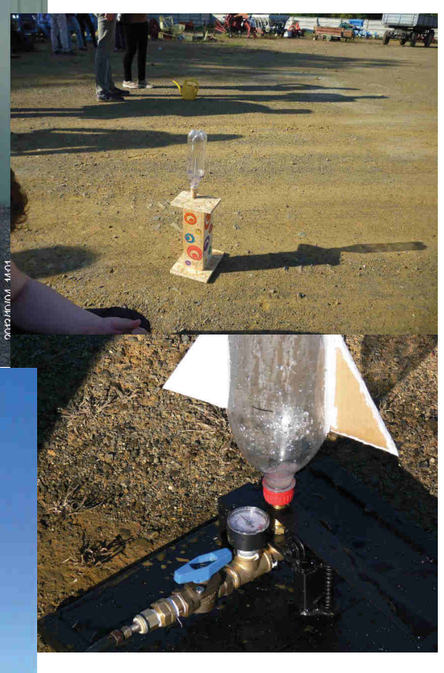










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# Do it yourself – easy to prepare demonstration tools and experiments in physics and chemistry part 2.

**Prepare yourself! Work and play!**

- A home-made stroboscope.
- A vibrating jet of water, illuminated by a stroboscope (total darkness needed).
- An automatic „cleaning machine” or „running bug” made from nailbrush.
- An easy way to draw Lissajous curves.
- Some other demonstration tools or „toys“ made from tincan, plasic bottles or other recycling materials, like
  - Stirling engines.
  - Water rocket.
  - Steam turbine models.
  - Franklin’s bell.
  - Playing with wind turbine models – how long wind do you have?
- Shooting with a compressed-air gun.

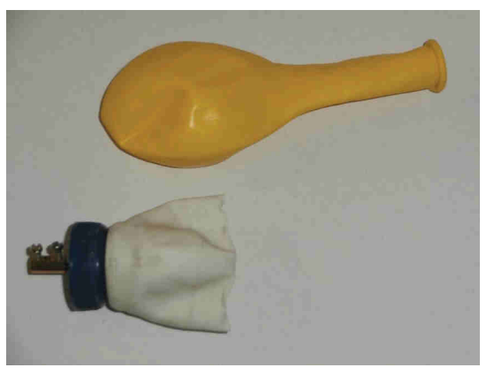
**Example: parts of a Stirling engine:**



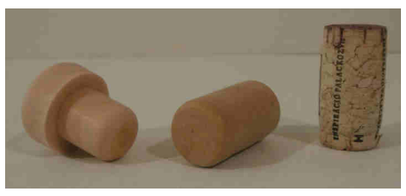


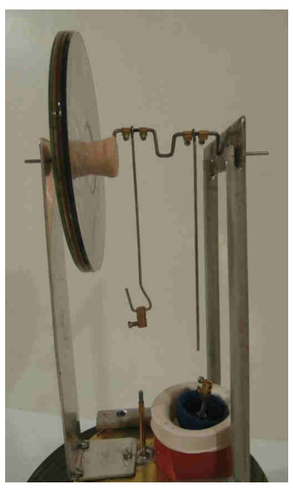









Many of the above things have been made by children and students at Chemistry and Physics Summer Schools.

Do not hesitate to try these things at home!

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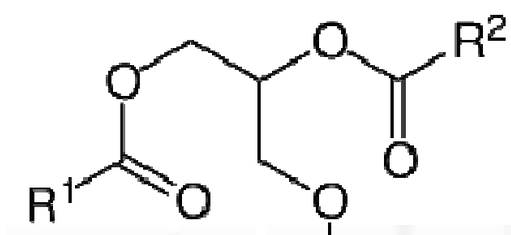
Nika Cebin| Gimnazija Ledina | Ljubljana | Slovenia

# Nature's finest – olive oil

## Food and sustainability

Since 6000 BC olives have been harvested from an olive tree and processed into olive oil with cold pressing.
Olive oil contains monounsaturated fatty acids therefore it is less likely to oxidate than vegetable oil. The main kinds are virgin, extra virgin and lampante olive oil. Istrian Belica and Štorta from Slovenian Istria have a protected designation of origin and high values of natural antioxidants. Expiration date is 18 months while kept in dark glassware not exposed to air, sunlight and warmth above 20°C.




**Beneficial effects:**

- protects from arthritis, coronary diseases, breast cancer,
- stimulates oxidation of bad holesterol, secretion of stomach juices,
- better absorption of vitamins,
- presence of antioxidants.

**Usage in health care, cosmetics and gastronomy:**

- lip balm (olive, almond oil and beeswax),
- anti-age peeling (extra virgin olive oil, honey and sea salt),
- *bread*; *spread from chickpea*; *millet with dark chocolate*.

100% Great!

## Conclusion:

Olive oil is safe fat. It is easy to digest, promotes the secretion of gastric juices and allows the better absorption of vitamin E. It is very successfully used in natural cosmetics and healthy food.

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Daiga Krieviņa and Māra Rābante | Marupes elementary school | Marupe | Latvia

# Pupils‘ night of applied sciences

## THE PURPOSE OF PROJECT

The goal of the project is to raise pupils’ interest in science, give a chance to get to know the practical science and to learn the demonstration of experiments and public speech skills as well as to observe theoretical regularities

## THE BENEFITS OF PROJECT FOR PUPILS

- Interests in nature science.
- The skills to see relationship of science and life.
- Involvement of parents in the curriculum implementation.

## THE EXPECTED RESULTS OF PROJECT

Pupils’ ability to explain and demonstrate simple science experiments which are used as examples in further study process in various subjects.

Responsibility

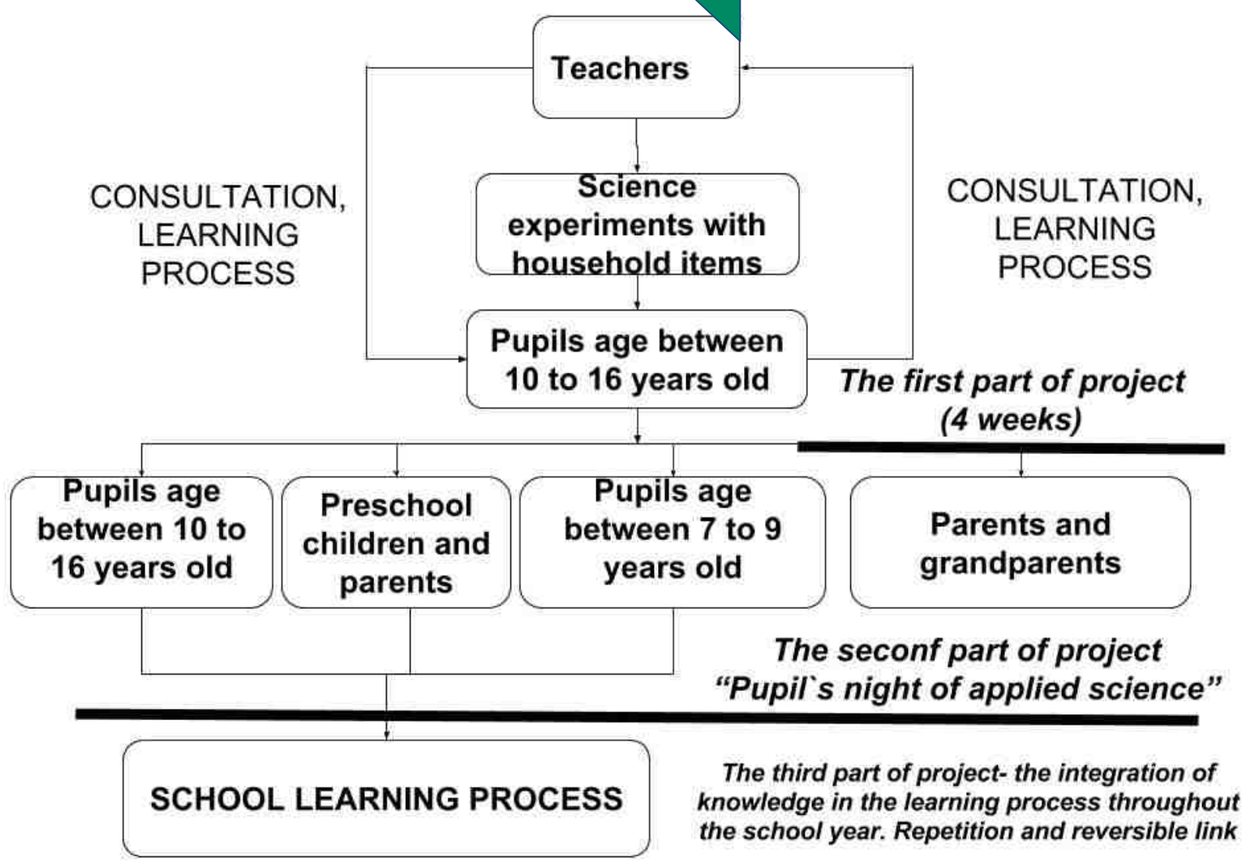
Planning of finance

Public speech

ICT

Develop mutual learning

Practical activities



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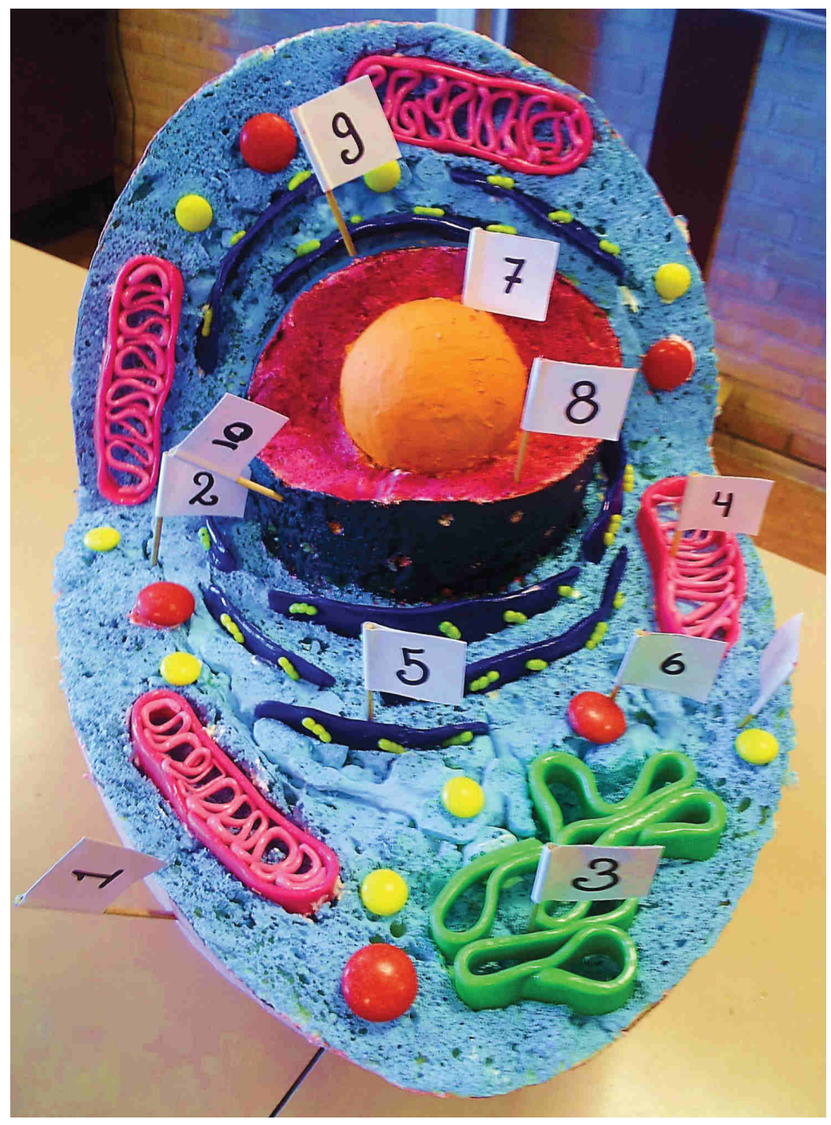
**Jolanda de Vries| Damstede Lyceum | Amsterdam | The Netherlands**

# Make your own 3D cell

## With simple materials



Students make a 3D-model of an animal cell or plant cell, with simple materials. They have to plan, design, work together and make use of the theory and pictures in their textbook and search for more information on the internet. They also have make a definition of the functions of the organelles.

This project will help students to understand the form and structure of organelles and cells. They will remember this subject better than only reading the theory in the book.

You will learn much more than just reading the text and pictures in the book. And it is fun to do too!

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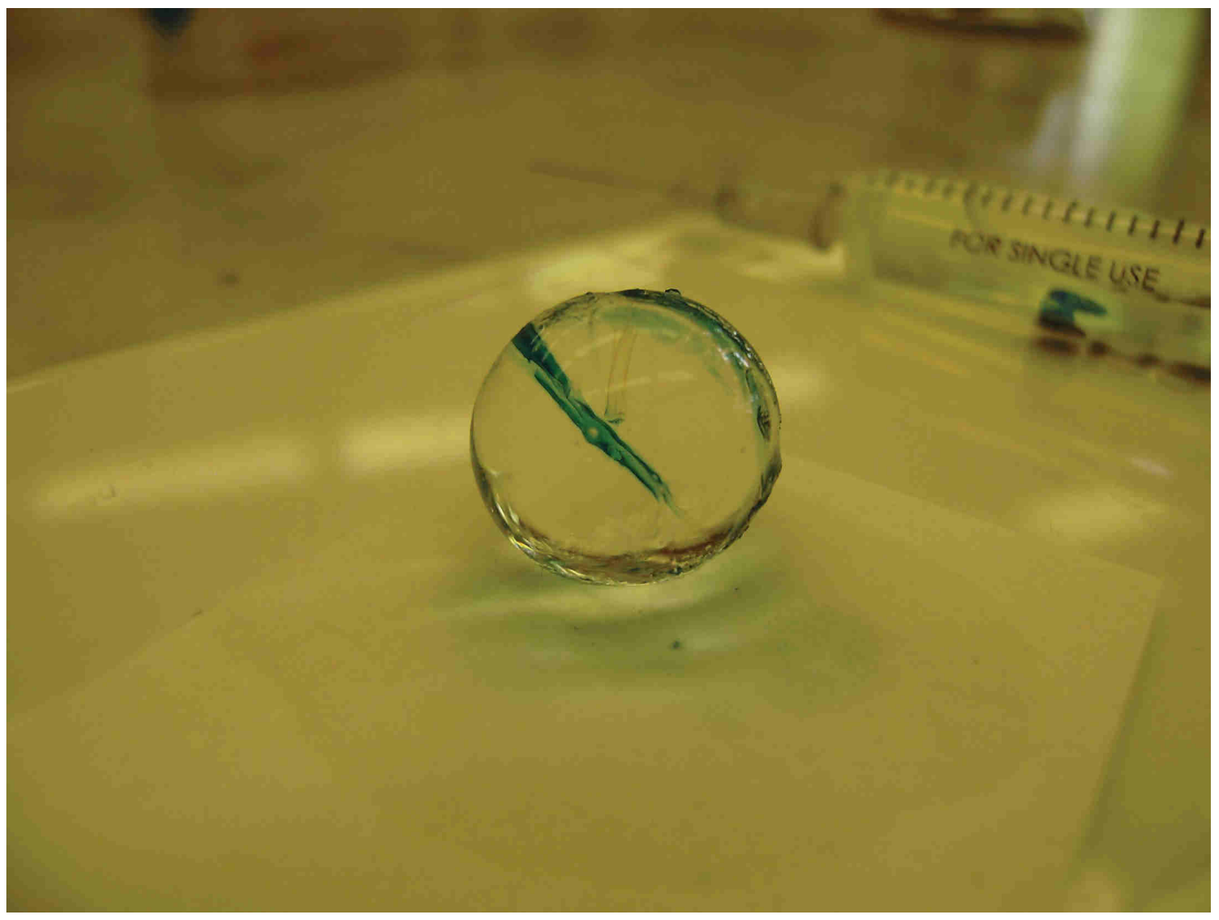
Dobóné Dr. Tarai Éva| Berzsenyi Dániel High School | Budapest | Hungary

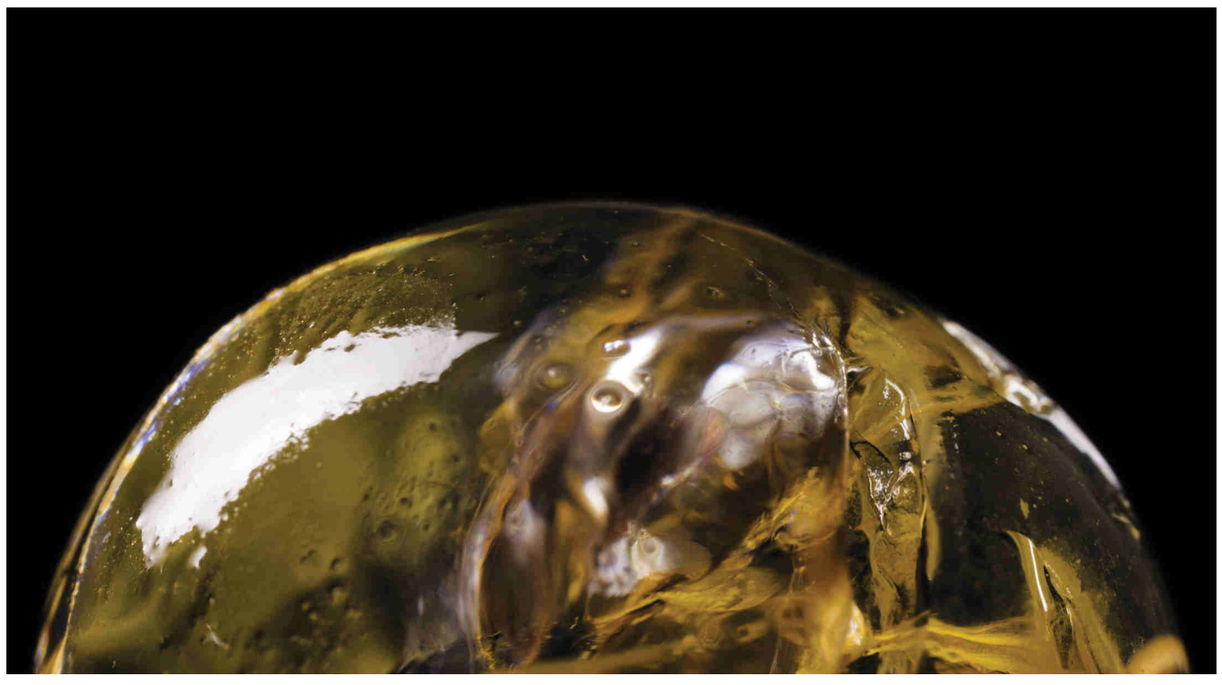
# Small is beautiful I.

## Microscale chemistry in the classroom

Hydrogel balls shrink as they dry out and swell up again when they are placed in water. As they swell up they retain their spherical shape,  thus forming an aqueous bead in which chemical reactions can take place.

The solutions of the participating reagents can be injected into a hydrogel ball using a hypodermic needle. Due to the hydrogel ball's spherical shape it acts as a magnifying lens and can make the reaction more visible.



Precipitation  reactions  in hydrogel  balls

Learn how to carry out microscale experiments for greener chemistry teaching – and less washing up.

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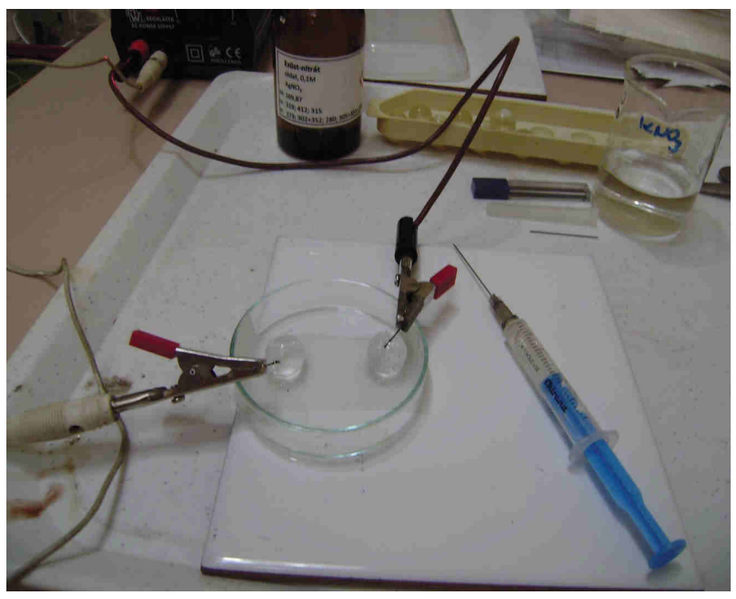
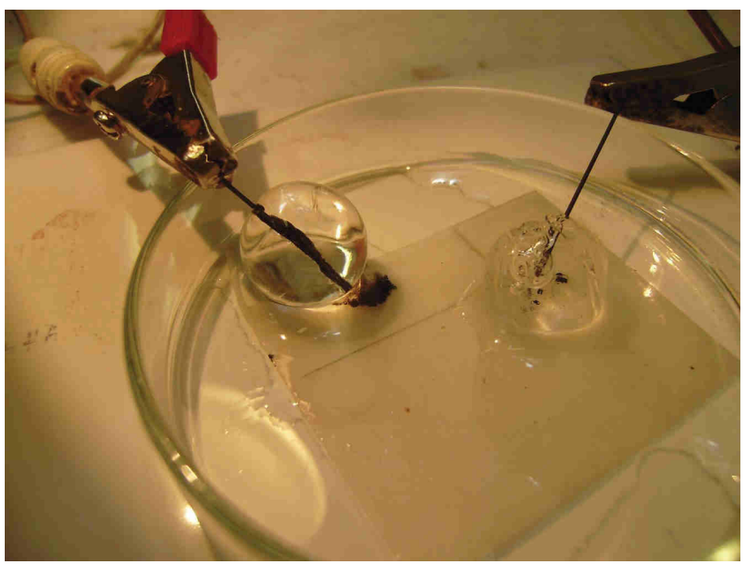
**Dobóné Dr. Tarai Éva| Berzsenyi Dániel High School | Budapest | Hungary**

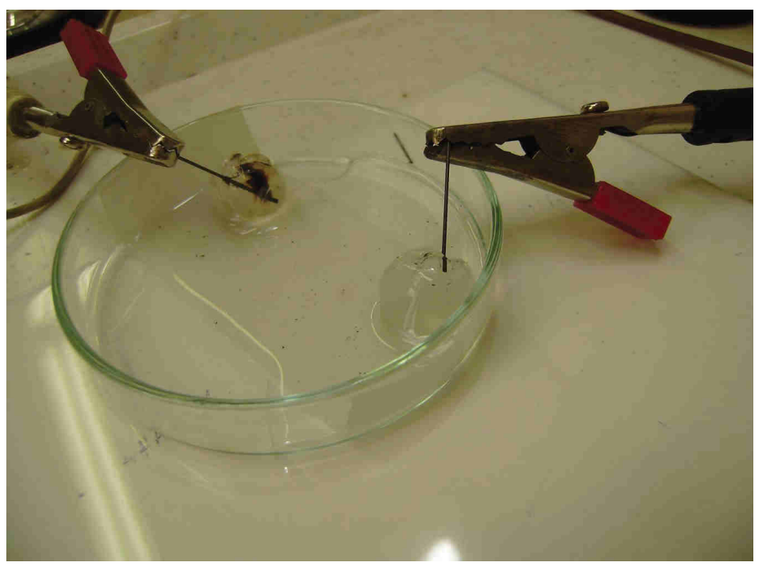
# Small is beautiful II.

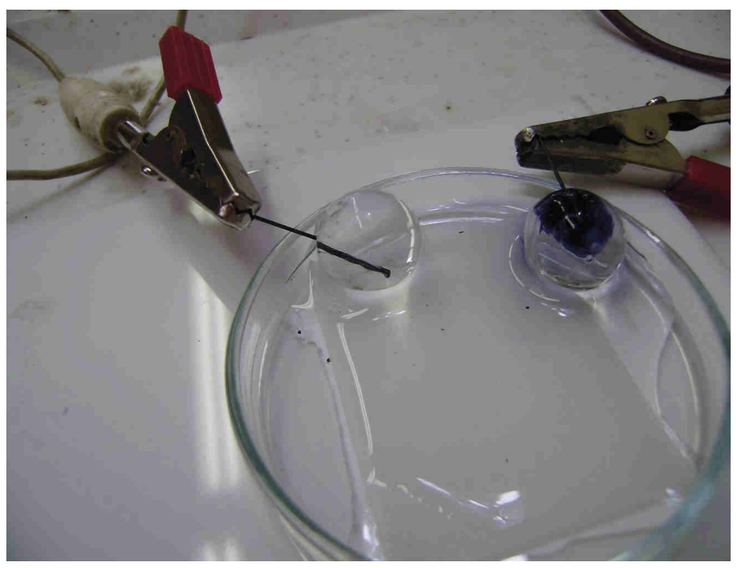
## Microscale chemistry in the classroom

Electrochemical reactions in hydrogel balls:
The balls are placed on filter paper soaked with the electrolyte. The electrodes are graphite leads from a mechanical pencil. Using a Pasteur pipette some silver nitrate/zinc iodine/etc. solution is inserted into the hole in each hydrogel ball where the electrodes enter it.

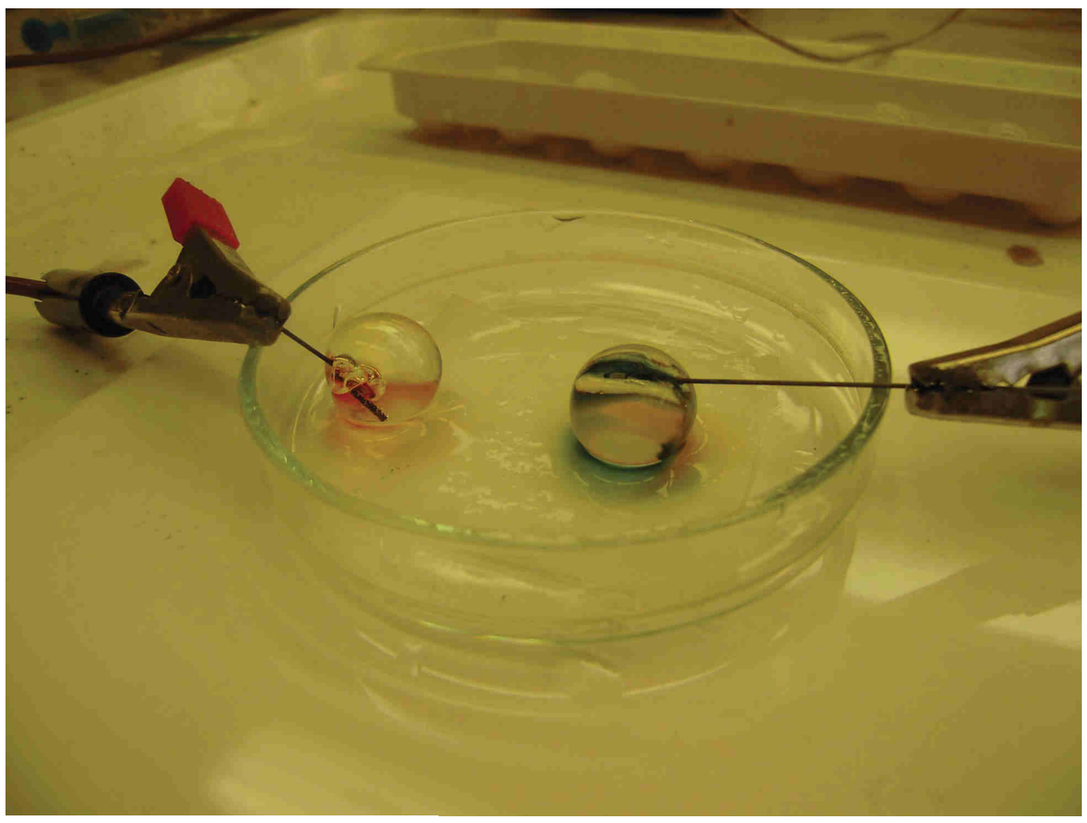


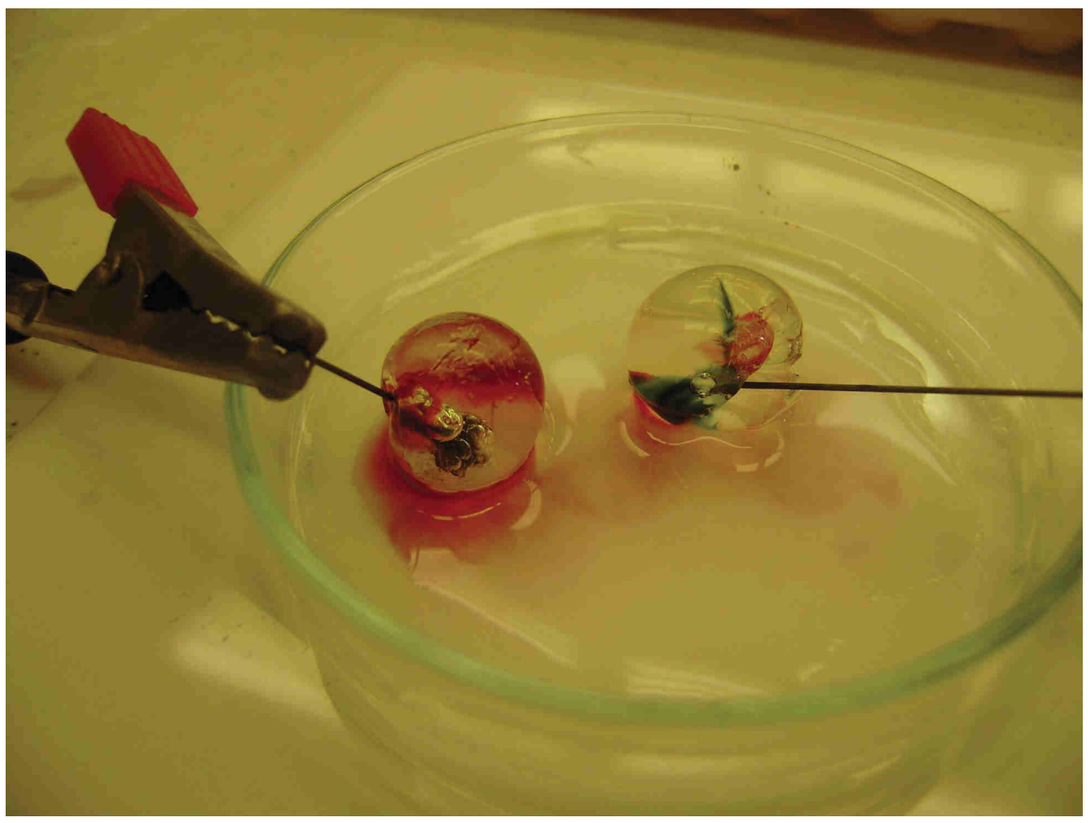






Electrolysis of metal salt solutions (above) and electrolysis of water using universal indicator solution (below).





BERZSENYI GIMNÁZIUM 1858

Apart from being spectacular, this way of carrying out experiments has the advantage of using less chemicals and thus producing less waste.

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**Emanuel Bettencourt| AE Dr Francisco Fernandes Lopes | Olhão | Portugal**

# Xico Lopes eggnaut

## Movements in Earth and Space

Agrupamento de Escolas Dr. Francisco Fernandes Lopes | Olhão

In the middle of 1st trimester, a challenge is made to students of the 11th grade where they apply their knowledge of Newton laws of motion, to design, built and test a water rocket as well as a recovery system.

*XicoLopes* eggnaut is an ”astronaut” that wants to explore other planets and so he needs transportation and arrive safely.

Working in groups searching solutions for the problem, an Inquiry Based Learning activity is held to students.

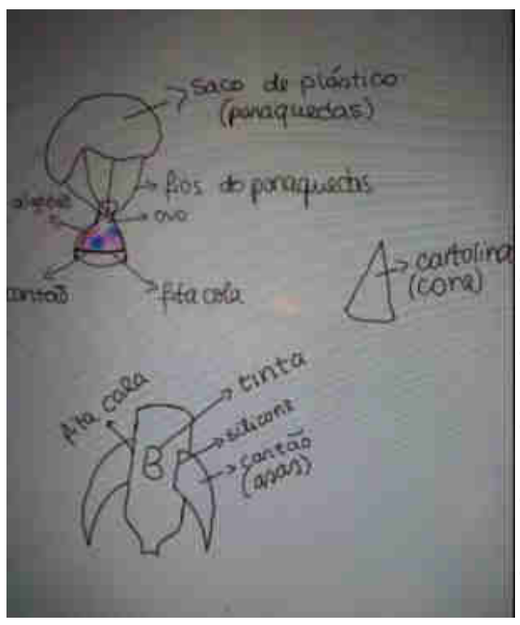
Students build a rocket from a 2L soda bottle and a space capsule where a raw egg size L will be put.

At the launch day the bottle is attached to the platform. Safety procedure are checked and air will be pumped inside the bottle (~75 psi), that already has 200 mL of water.

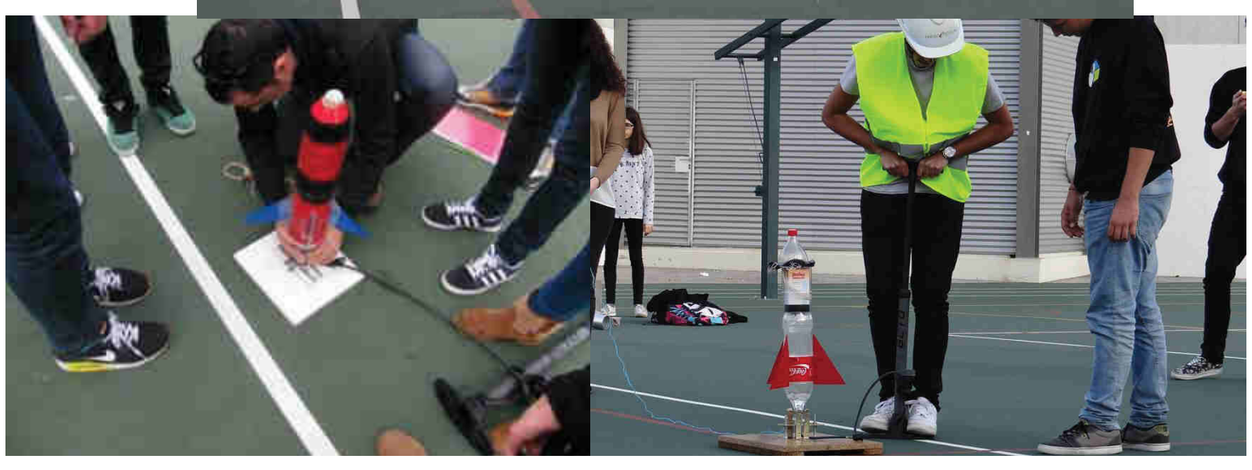
Safety checked (again), timers set, countdown and ... the egg is launched up to ~20m high.

The challenge continues since the eggnaut must arrive intact to the ground.

**More time in the air means more points**.




- egg, size L;
- soda bottle 2L;
- air pump;
- water;
- launch platform;
- timer;
- recovery system;
- cottom or other;



Students are engaged, motivated, hands-on, because its an activity that they Do everything: design, built, test and compete.