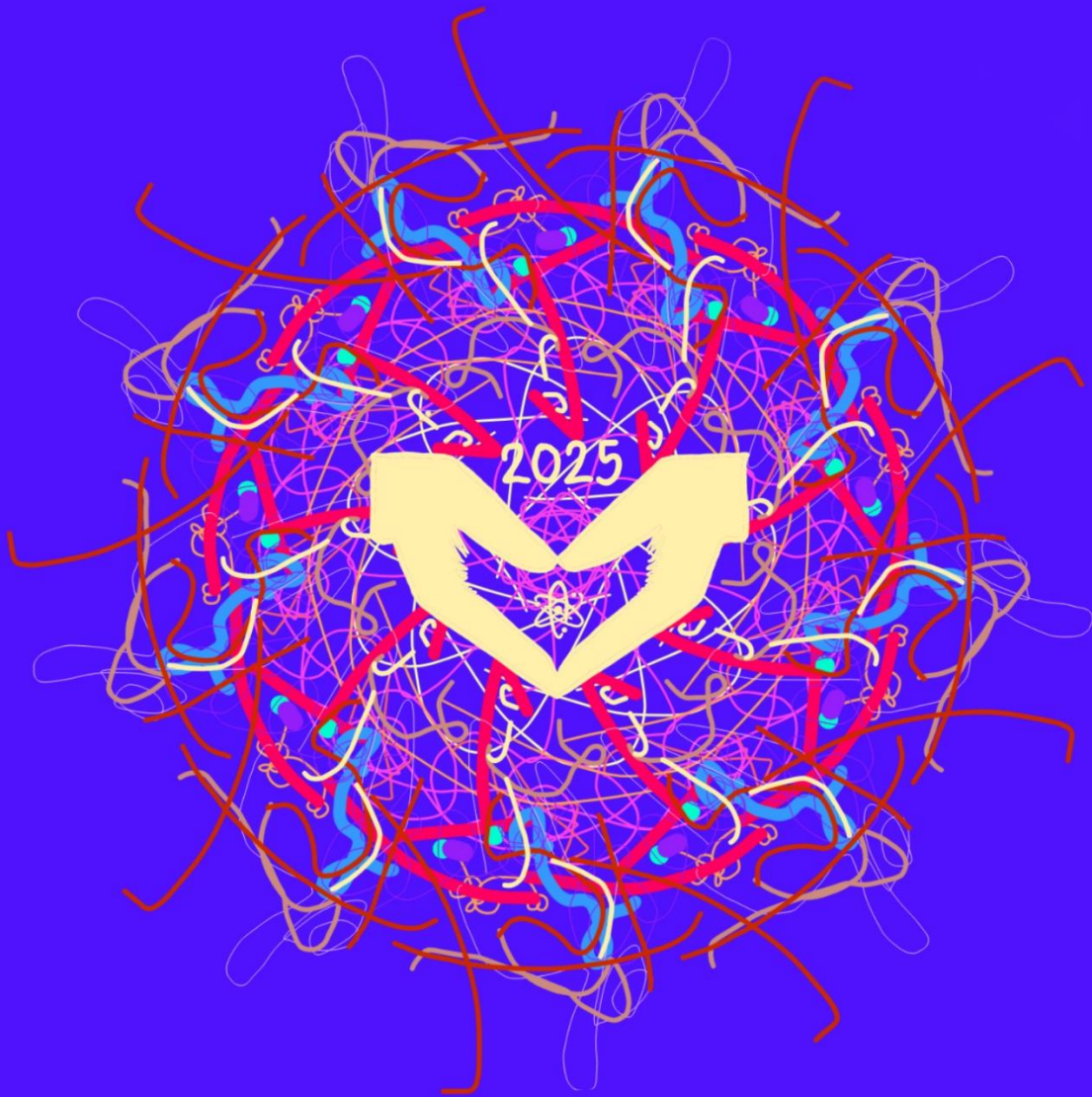


AKADEMEIA



SCIENCE FAIR

Akademeia Booklet

SCIENCE FAIR



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1. Science Fair Stations

Stations Titles and Agenda (Rooms and Times)

Station	Leader(s)	Time	Room
Elephant Toothpaste	<i>Student-run</i>	1 st 40' (10:10-10:50)	Reception
Flame Tests	<i>Student-run</i>	1 st 40' (10:10-10:50)	13
Elephant Toothpaste	<i>Student-run</i>	2 nd 40' (10:55-11:35)	Reception
Flame Tests	<i>Student-run</i>	2 nd 40' (10:55-11:35)	13
Explosion without explosives	Mr Dariusz Aksamit	1 st 40' (10:10-10:50)	5 + Pitch
Screaming Jelly Baby	Mr Hristo Stefan	2 nd 40' (10:55-11:35)	2 + Pitch
Crater Forensics	Mr Shun Wong	1 st 40' (10:10-10:50)	4a
Small worlds in the pond....+ birds observation	Dr Mark Baynes	80' (10:10-11:35)	3
Fermented foods	Mr Tomasz Cebo	80' (10:10-11:35)	6

Station	Leader(s)	Time	Room
Ion wind thruster	<i>Student-run</i>	2nd 40' (10:55-11:35)	11
Cooling by heating?!	<i>Student-run</i>	2nd 40' (10:55-11:35)	11
Magnetic breaking	<i>Student-run</i>	2nd 40' (10:55-11:35)	11
Make first 3D printed model	Ms Sviatlana Volchak	80' (10:10-11:35)	11
Cloud chamber	Mr Adam Markiewicz	1 st 40' (10:10-10:50)	11 & 10(darkroom)
Pigments and molecular cuisine	Mr Maksymillian Matuszewski	80' (10:10-11:35)	13
Fire Bubbles on Hands	<i>Student-run</i>	1 st 40' (10:10-10:50)	13
Thermite	Mr Hristo Stefan	1 st 40' (10:10-10:50)	13 (14)
Organ Dissection	<i>Student-run</i>	80' (10:10-11:35)	15
Blast furnace on match head	<i>Student-run</i>	2 nd 40' (10:55-11:35)	13
DNA extraction from fruits	<i>Student-run</i>	2 nd 40' (10:55-11:35)	Reception

Y9 Poster Walks Sticker Section:

1st

2nd

Descriptions

1. Flame tests – When heated, metals produce a rainbow of diverse colours. Each of them is bright and unique, so you are welcome to see this chemical palette!



2. Elephant toothpaste – an unexpected emergence of a large foamy substance will fascinate you. Easy to make, incredible to observe



3. Organ dissection – if you love anatomy and are brave enough to look inside an animal body, this practical would be an ideal, educational lesson.



4. The Screaming Jelly Baby – a ‘sweet’ demonstration making a loudly bursting flame from a harmless jelly bear



5. Thermite reaction – intense heat and spectacularly bright molten metal – result of a redox reaction thermite undergoes



6. Fire bubbles on hands – our volunteers are not scared to tame a fire to impress you. Come to hear how this amazing experiment actually works.



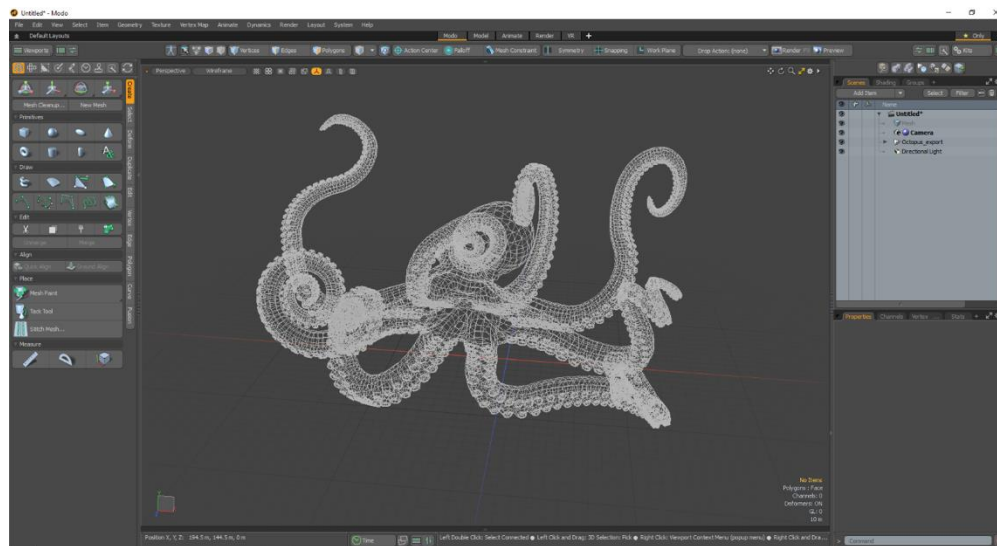
7. DNA extraction - Genetic material is not just an abstract thing deep inside our cell – each human DNA molecule is 2 metres long! The method of extracting DNA from fruits is very easy and fun, so you can explore it in this experimental station.



8. Explosion without explosives - a fun and fascinating demonstration of rapid gas expansion.



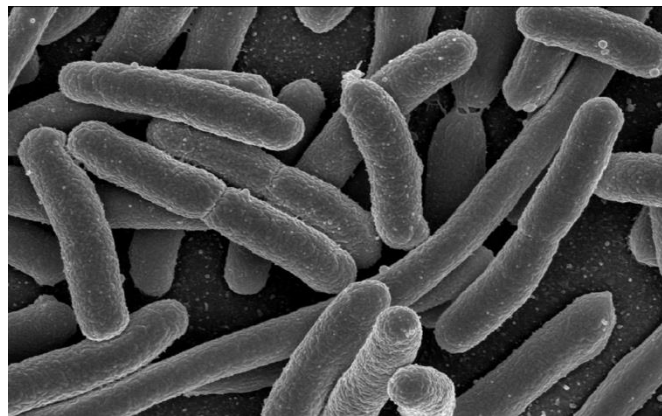
9. Make first 3D printed model - our students will teach you how to create designs not just on paper, but make them real models. Good for art and design students.



10. Pigments and molecular cuisine - explore techniques that are popular in restaurants and get to know how to create eatable bubbles.



11. Small worlds in the pond... - a dark pond might hide hundreds of diverse species, and during our science fair it will open its secrets for you. You will have an opportunity to observe different bacteria and protists.



12. Cloud chamber - see invisible: our particle detector visualises the passage of ionising radiation present in our environment

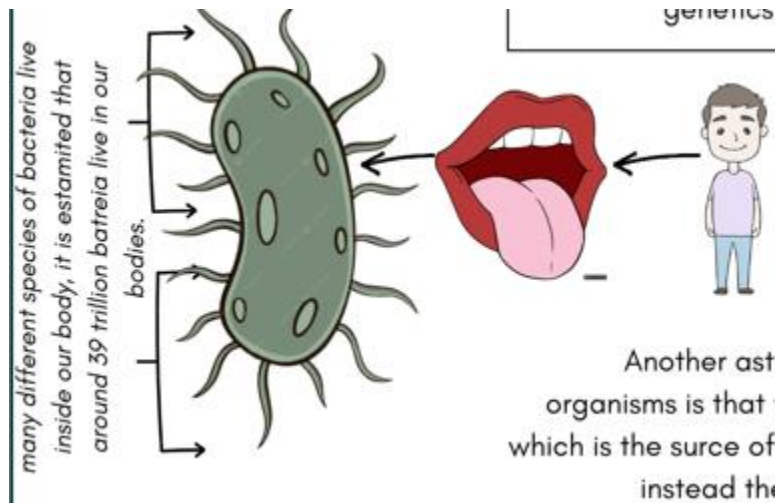


13. Fermented food - discover the magic of fermentation by making your own kefir! Test its pH, density, and more—plus, your creations might help support a good cause!



2. Y9 Blog Summaries

#1 Baginski: “Uni vs Multicellular Organisms”



All life forms present on earth are organisms, animals as big as whales and microorganisms as small as bacteria. If we look even closer, all organisms are made up of tiny cells, which often work in large groups in order to keep the organisms functioning. In some interesting cases the entire organism can consist of only one cell. These organisms are called unicellular organisms (prokaryotes).

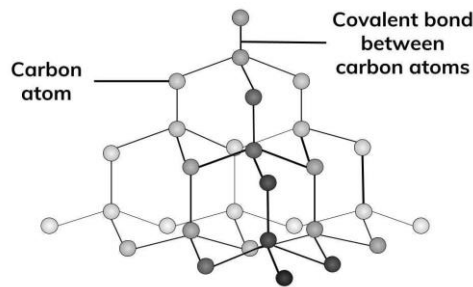
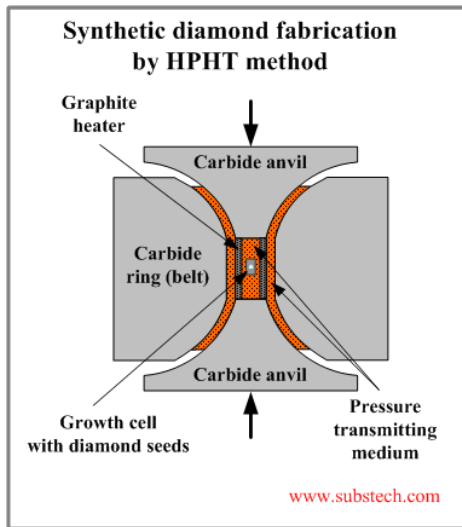
#2 Chrystowski: “Are electric cars really eco-friendly?”



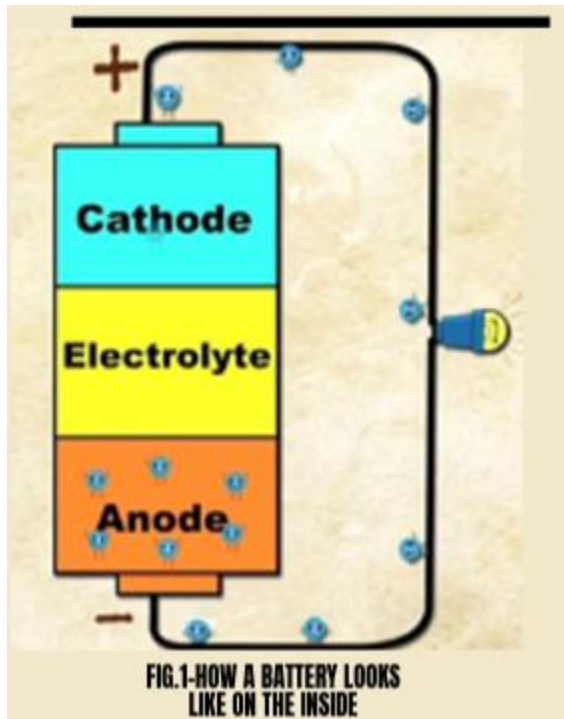
If we want electric cars to be a better alternative than traditional cars there have to be some things changed. While the impact on the planet when driving is zero, but in most of the country's electricity is produced in a very not ecofriendly way. If we would just improve, the way of producing electricity than electric vehicles will make a big role in making more sustainable future.

#3 Chukhlantsau, Olendski-Moustacakis: “How are we able to make lab diamonds?”

In this blog we have shown and explained that natural diamonds are not the only ones to exist, there are also synthetic diamonds – HPHT and CVD. We put down the exact steps to making both, we also wrote the differences as well as the similarities between the two types of synthetic diamonds and added a bit of extra information about both.



#4 Darowski, Janczar: “ALL ABOUT BATTERIES”



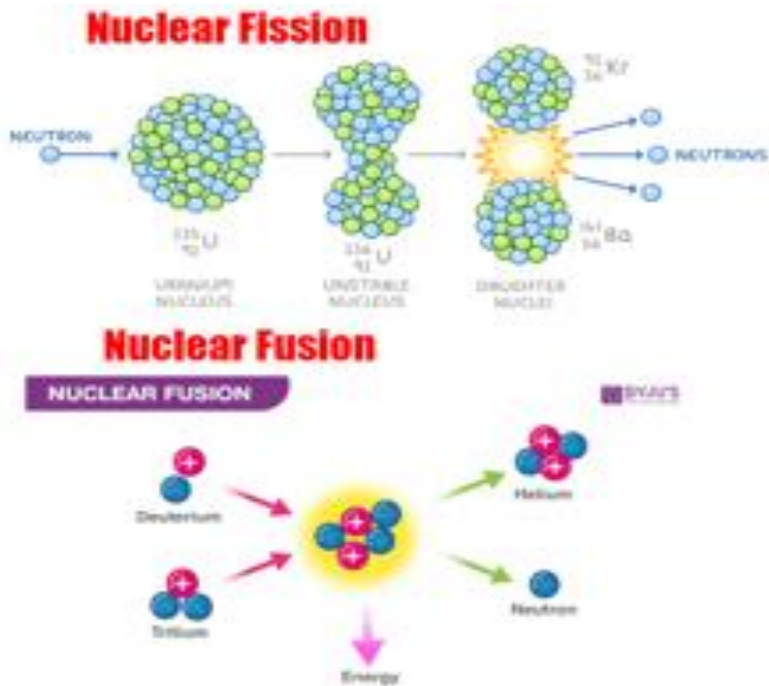
Batteries appear in many shapes and sizes. There are also many different types of batteries, the most notable of which being Lithium, Alkaline and Silver Oxide. Each of these, has something unique and special, however the most universal one is Lithium Batteries. Despite their differences, they all work similarly, as they have 2 terminals and an electrolyte.

#5 Golab-Glaz, Koltonik: “Itchy, scratchy, and sniffly”



Allergies are caused by the overreaction of the immune system to different substances that are harmless to most people. There are two factors that cause Allergies Genes and Environments. One cause of allergies is lack of exposure to microbes as a child. Which results in the underdevelopment of the immune system, making it identify harmless substances as threats. Allergies however come from lack of exposure and genes. Meaning that if your parents had allergies, you are most likely to have them too.

#6 Karpenko: “Nuclear Weapons”



Nuclear/Atomic weapons, created by splitting the atom and improved by combining two atoms have dramatically changed history.

From their invention in World War II to the present day, these weapons have become a massive and destructive scientific achievement. However as long as the prospect of nuclear war threatens us, we will strive for peace and disarmament and shape the future course of these powerful tools of war.

#7 Koszutska, Woolley: “The World of Schizophrenia”



Schizophrenia is an extremely unbearable mental health illness. It can affect how people behave and think. It consists of hallucinations, delusions and disorganization. As an example, a schizophrenic person might see their parents in the kitchen when actually they are home alone. Another Episode can consist of voices and/or faces that overlap. These visions can be unpleasant and terrifying for the person.

#8 Lubas, Mashenskaya: “ANAPHYLAXIS CAN KILL YOU”



Studies on anaphylaxis demonstrate that fatalities are not increasing over time, despite a gradual rise in the number of new cases. The data suggest improved medical interventions and awareness may contribute to the declining fatality rates.

#9 Nogajczyk, Szymanski: “How do glow sticks work?”



A glow stick is a plastic tube filled with chemicals that produce light through the chemical reaction called chemiluminescence. Glow sticks are mainly used for fun, for example parties or some events like concerts or festivals. It is also used during emergencies when other light sources are unavailable.

#10 Swierczynski: “The science behind electric dirt bikes”



•In conclusion , electric dirt bikes are revolutionising off-road riding. They demonstrate what is possible with new technology and are entertaining, quick, and environmentally responsible.

#11 Swolkien, Uznanska, Wasiak: “HOW TO MAKE BATH BOMBS AND WHAT IS THEIR CHEMICAL SECRET?”



Bath bombs have a chemical reaction when exploding in the water and turning into a beautiful range of different colors. The baking soda and the citric acid makes it dissolve and sizzle in the water. While putting a bath bomb in the water it produces Carbon dioxide and gives of its fizzing When adding baking soda known as sodium bicarbonate and combining it with citric acid, these 2 ingredients are both in dry forms and don't give of the reaction, but when putting it in the water it creates the chemical reaction Made by this two that give of when in the water. In the bath bomb there is also Magnesium sulfate, known as bath salts, that are in the bath bomb that relieve pain in your sour muscles.

3. Y10 Experimental Project Abstracts

#1 Alexopoulou, Bakic-Pawlak: “The splitting of water AKA Electrolysis”



In this experiment we will be splitting hydrogen and oxygen in water through the use of electricity. This procedure is called electrolysis. We are interested in this topic because we would like to see how it looks like to separate these two elements. This is an excellent experiment to conduct because it is not looked into a lot and will be very engaging and fascinating.

#2 Borowiak, Wojtulewicz: “Beauty Blenders and Bacteria - A Study of Storage Hygiene”



In this experiment we aimed to investigate how storage conditions impact the spreading and growth of bacteria and fungi on makeup sponges as well as the difference in the results using sponges with varied levels of contamination. Firstly, to investigate this, we prepared three different makeup sponges, one cleaned, one uncleaned for a month, and one uncleaned for two months. Afterwards, we collected samples of the substances in each of the sponges by soaking them separately in distilled water to allow the bacteria to exit the sponges and mix with the distilled water. We placed samples from each sponge in two agar plates, one of which stored in 40 degrees celsius (oven), and the other 12 degrees celsius (fridge). We collected the samples using a pipet to collect the mixture of bacteria realised in the distilled water and placed samples from each sponge into the two agar plates, storing them in different temperatures. The results showed us that the agar plates stored in the fridge at 12 degrees celsius had significant bacteria growth, while the plates stored in the oven at 40 degrees celsius had no bacteria growth visible by eye. We predict such results have been recorded due to over heating or drying out in 40 degrees. Our results suggest that storing makeup sponges in cool conditions encourages bacteria spread, while warm conditions prevent it.

#3 Iwinski, Steczniewski: “Elephant Toothpaste - How Different Substances Affect the Foam”



In our experiment we are trying to compare how the different amounts of substances like hydrogen peroxide and dish soap affect the amount of foam coming out of the beaker. We will see how high the foam will go up, in what different way does exit out the beaker when the catalyst gets in contact with oxygen and the dish soap blocking the oxygen to create foam. In our experiment we also have to understand how the chemical reaction of elephant toothpaste functions to fully understand our experiment. Elephant toothpaste works by the catalyst which in our case will be warm water and yeast solution reacts with the oxygen, decomposing it into water and it is accelerated by the catalyst which in our case will be yeast and warm water. By pouring the yeast mixture in the hydrogen peroxide and dish soap. Then the dish soap that is also in the solution captures the oxygen gas and creates a foam that is hot. Understanding the basics of our experiment can help us improve our experiment procedure and get us a more accurate result that we understand.

#4 Kusiak, Ostatkiewicz, Song: “WHEN TIME MEETS CHEMISTRY - THE IODINE CLOCK REACTION”



Our aim for this experiment was answering the following two questions.

- How does the Iodine Clock Reaction work?
- How does the change of concentration in Iodine/Starch affect the rate of results?

#5 Latek, Romanowski: “Investigating the rate of reactivity”



We conducted an experiment in which we investigated how surface area, temperature and concentration affect the time of reaction and temperature of vinegar mixed with sodium bicarbonate. It is useful to obtain this kind of information as it may be useful in domains such as cooking. First, we tested for temperature. We took three beakers and set them to different temperatures and then added baking soda. Next was surface area, we had the same amount of baking soda in room temp. and two types of baking soda – one was powder and the other was granular. Finally, we tested concentration by changing the concentration of the vinegar. Our predictions were very similar to the results with some differences. We learnt how we can improve our time of baking and of experimenting using these factors.

#6 Szlaga, Czerwonka, Tokarska: “Saponification at home – two different bases”



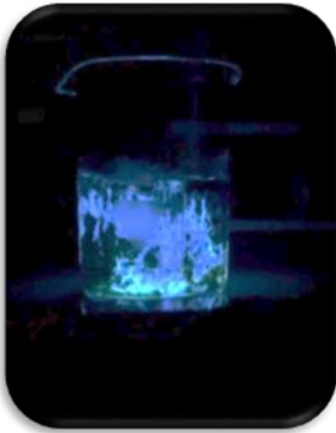
Figure 1. Baking soda-based soap.



Figure 2. Caustic soda-based soap

The project was based on comparison of saponification process using two different bases. In the first experiment we used the baking soda, NaHCO_3 , but the attempt to make soap was unsuccessful, as the final plant oil mixture remained in a liquid state and did not solidify. In contrast, in the second experiment we used a stronger base, NaOH (commonly known as caustic soda or lye), resulting in successful saponification. This experiment helped determine whether soap could be made with baking soda instead of caustic soda.

#7 Walker, Janowski: “Forensic Science”



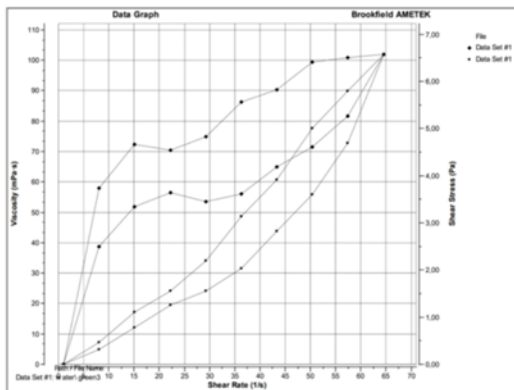
Chemiluminescence of luminol solution in the presence of hydrogen peroxide catalized by metal ions.

Our research initiative aimed to test the choice of metal ions on chemiluminescence of luminol which has various applications but most importantly is able to act as a chemical light source, which differs from regular physical lights.

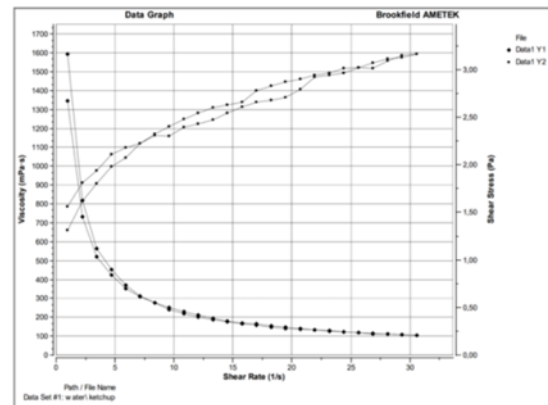
Using the light source detector we determined that in the presence of the copper ion (Cu^{2+}) the emission of luminol lasted far longer, but less brightly than in the presence of the potassium hexacyanoferrate, which contains iron ions (Fe^{3+}).

We could prove that hemoglobin, which has iron ion (Fe^{3+}), catalyzes the reaction and therefore is able to detect blood.

#8 Zaviarzhnets, Oskroba: “Viscosity of non-Newtonian fluids”



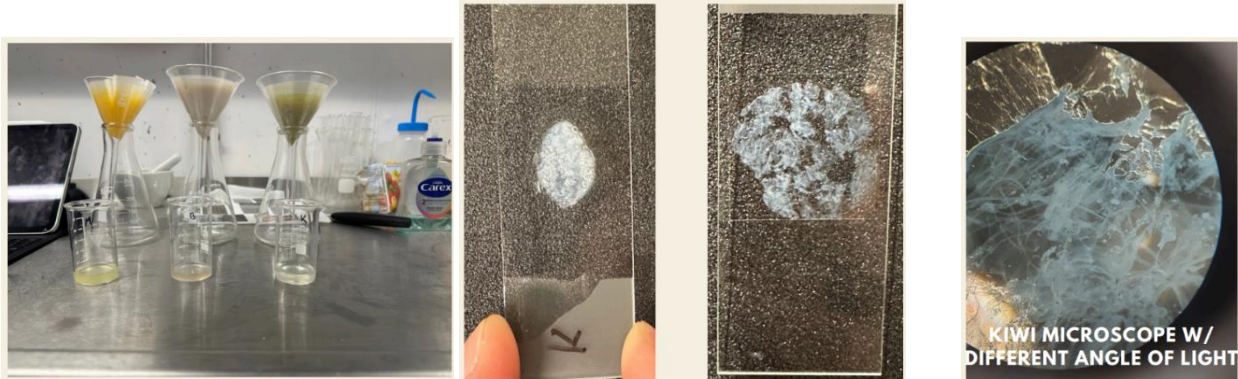
Oobleck



Ketchup

In this project, we wanted to find out what the relationship between viscosity, shear rate, and shear stress is in non-Newtonian fluids. We conducted an experiment in which we used a rheometer to observe the viscoelastic behaviour of three samples, Oobleck (non-Newtonian), Ketchup (non-Newtonian), and water (Newtonian).

#9 Rutkowska: “Fruit DNA Extraction”



Filtration

Kiwi

Mango

This study investigated the extraction of DNA from three different fruits - kiwi, mango, and banana using a simple extraction process. This method involved mechanical disruption, detergent-based cell lysis, filtration, and DNA precipitation using cold ethanol. An initial trial conducted at home failed due to the use of impure alcohol and inadequate filtration, highlighting the importance of precise materials and conditions. A second trial, conducted in a laboratory setting with pure ethanol and proper filtration, successfully isolated visible DNA strands from all three fruits. The results, observed under a microscope, revealed variations in DNA quantity and structure among the fruits, with bananas yielding the most DNA due to their triploid genetic composition. This experiment demonstrated the effectiveness of common household materials in extracting DNA and emphasized the significance of methodological accuracy in the research.

4. History of Science



ANCIENT LEATHER

Leather is produced from animal hides; in antiquity, this process included:

- Scraping – removal of lipid layers and portioning the hide
- Preservation – usually salting the hide to prevent rot and decay
- Pre-Tanning Preparation: Soaking, Pressing & Splitting

Hides are soaked in water, wrung, and more layers are removed

- Liming (soaking) and Deliming (washing)

Cleaned hides are soaked in 'the milk of lime' - an alkaline solution

By changing the pH of the hide, collagen fibers release soluble proteins, which later clump together and can be washed away in water.

- Tanning

Hides are soaked in the final solution of tannins – compounds found in plants

Tannins will fix the collagen fibers, as well as prevent decomposition.



First Synthetic Plastics: Era of radios and sponges



Synthetic plastics serve as the pillar of today's world. They can be found everywhere in appliances, electronics, toys, and have many applications in all industries.

But what defines a synthetic plastic?

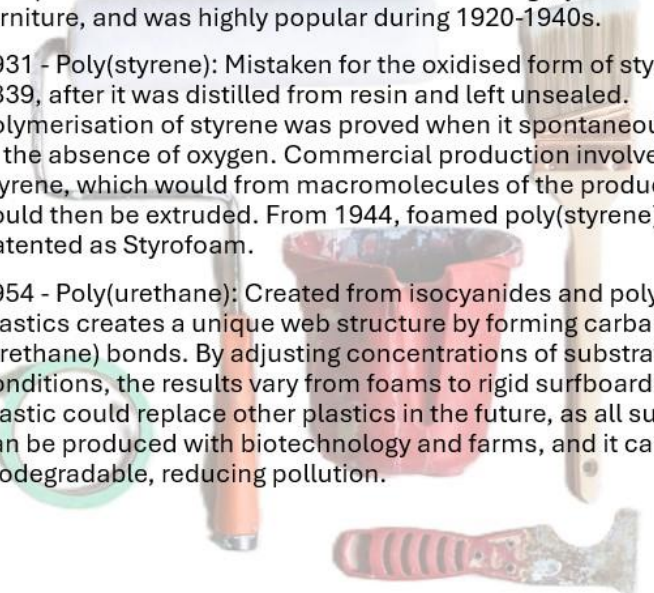
First, synthetic plastics are manufactured, and cannot be extracted from nature, although it can be made from natural materials, like starch. All plastics can be molded into a form, as well as contain polymers. Sometimes, the polymers are extracted, while other plastics require special conditions, and the polymers are created in-situ in the reaction vessel.

Timeline Overview:

1910 - Bakelite: First synthesised by Leo von Baekeland from a resin mix of phenol and formaldehyde. Commercial production as an insulator in electrical motors. Bakelite in its final version was a hard, dark plastic that was used in electronics casings, jewellery, furniture, and was highly popular during 1920-1940s.

1931 - Poly(styrene): Mistaken for the oxidised form of styrene in 1839, after it was distilled from resin and left unsealed. Polymerisation of styrene was proved when it spontaneously reacted in the absence of oxygen. Commercial production involved heating styrene, which would form macromolecules of the product, which could then be extruded. From 1944, foamed poly(styrene) was patented as Styrofoam.

1954 - Poly(urethane): Created from isocyanides and polyols, this plastic creates a unique web structure by forming carbamate (urethane) bonds. By adjusting concentrations of substrates and conditions, the results vary from foams to rigid surfboards. This plastic could replace other plastics in the future, as all substrates can be produced with biotechnology and farms, and it can be biodegradable, reducing pollution.



5. Science-related FUN FACTS

True or False? Myths around Sciences! [Answers on the back of this Booklet]

1. We use only 10% of our brain.
2. Humans evolved from chimpanzees.
3. Bananas are berries, but strawberries are not.
4. Antibiotics kill viruses.
5. Eating carrots improves your night vision.
6. Water conducts electricity.
7. Venus rotates clockwise; almost all other planets rotate counterclockwise.
8. Water expands when it freezes
9. Diamond is made of carbon
10. Soda fizzes due to a chemical reaction

Physics Fun Facts:

- **Water can boil and freeze at the same time:** This phenomenon is called the "triple point," where temperature and pressure are exactly right for all three phases of water (gas, liquid, and solid) to coexist in equilibrium.
- **A day on Venus is longer than a year on Venus:** Venus rotates on its axis very slowly; it takes about 243 Earth days to complete a full rotation. However, it takes only 225 Earth days for Venus to orbit the Sun.
- **You can never touch anything:** At least, not in the way you think. When you feel something solid, you are actually not touching it directly. At the atomic level, your

hand is repelling the electrons of this object. The forces between the electrons and atoms create the sensation of touch, but there is actually no physical contact at all!

Chemistry Fun Facts:

- **You can create gold from anything:** Chemistry appeared from alchemy — ancient ‘scientists’ were trying to find a way to make gold. Finally, it became possible with nuclear transmutation. Nowadays scientists have found a way to change number of protons in mercury atoms. However, it requires huge amounts of time and produces microscopic gold pieces.
- **Helium is the only element that cannot be frozen:** Unlike most gases, it stubbornly stays a gas no matter how cold the temperature is. The reason for that is a low mass of its atoms and no internal structure, which prevent solid bonds formation.
- **The colour of an element depends on its electrons:** The colour you see when looking at a substance is due to the way its electrons absorb and emit light. The element’s electronic configuration determined which wavelengths of light are absorbed and which are reflected.

Biology Fun Facts:

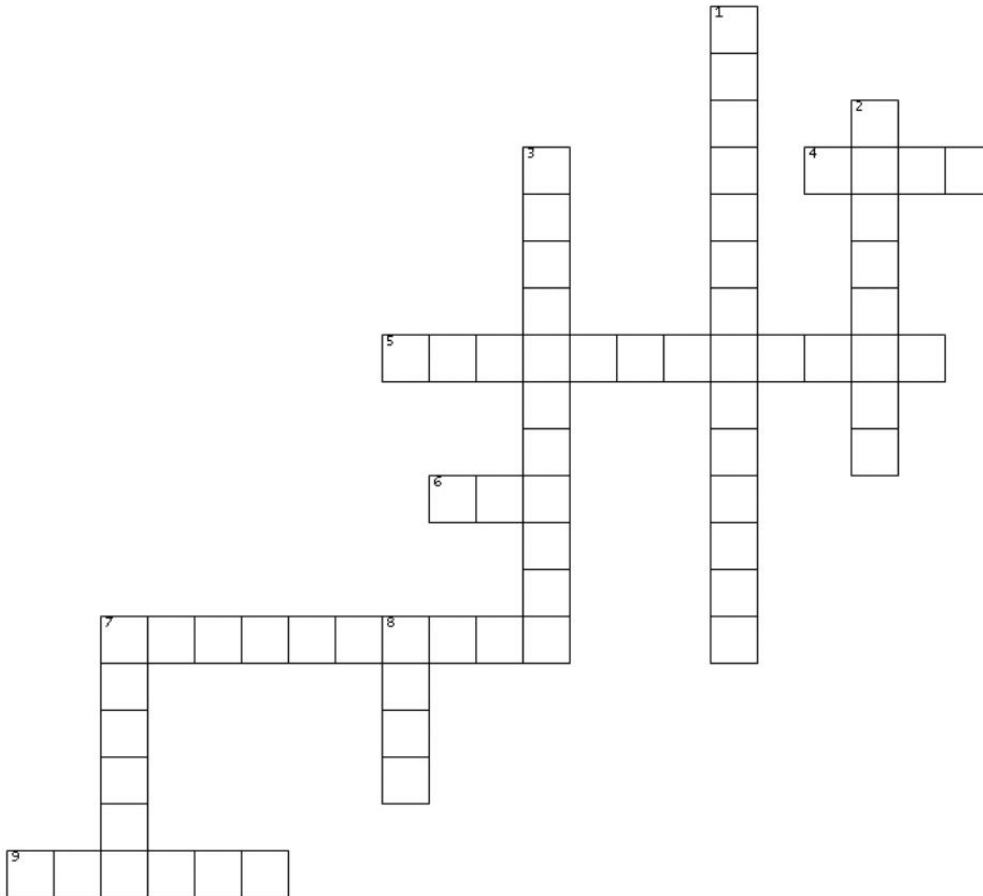
- **Sloths can hold their breath longer than dolphins:** Sloths can hold their breath for up to 40 minutes underwater, which is much longer than dolphins, who typically hold their breath for 10-15 minutes. Sloths can do this because they have a slow metabolism, and their bodies are adapted for conserving oxygen.

- **You have a "second brain" in your gut:** Your gut contains a complex network of neurons (about 100 million) known as the "enteric nervous system," often called the body's "second brain." This network can function independently of the brain and spinal cord, controlling digestion, and influencing mood and overall health.

- **The first cloned animal was a sheep:** In 1996, "Dolly the sheep" became the first mammal to be cloned from an adult somatic cell, using a technique called somatic cell nuclear transfer. Dolly's birth raised both scientific excitement and ethical questions about cloning technology.

6. Science-related Puzzles and Riddles

Biology Crossword [Answers on the back of this Booklet]:



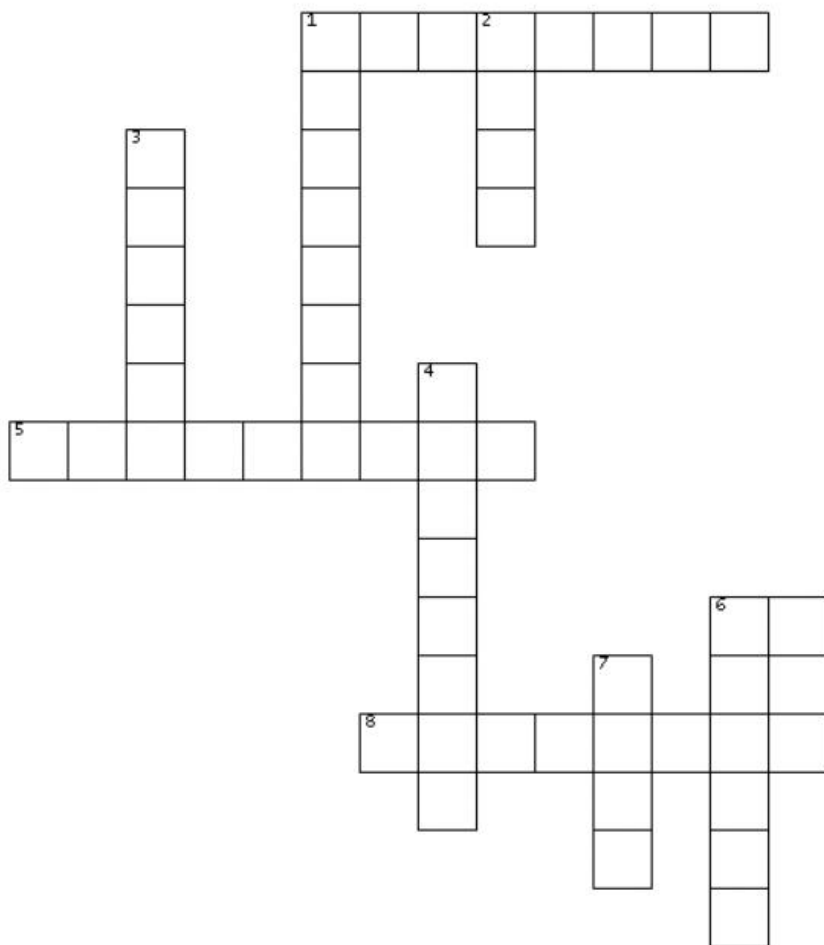
ACROSS

4. Wall, The outer layer of a plant cell
5. This organelle is known as the powerhouse of the cell.
6. This molecule carries genetic information in living organisms.
7. Proteins are made of these building blocks
9. This gas is a byproduct of photosynthesis.

DOWN

1. The process by which plants convert sunlight into energy.
2. The study of heredity and variation in organisms.
3. The biological term for the maintenance of a stable internal environment.
7. This type of blood vessel carries oxygenated blood away from the heart.
8. What is the basic unit of life?

Chemistry Crossword [Answers on the back of this Booklet]:



ACROSS

1. a substance that speeds up a chemical reaction without being consumed.
5. the process of losing electrons during a reaction.
6. a scale used to measure acidity or alkalinity.
8. a negatively charged subatomic particle.

DOWN

1. a type of bond where atoms share electrons.
2. a substance with a pH less than 7.
3. another term for a base that dissolves in water.
4. two or more atoms bonded together.
6. a positively charged particle in an atom's nucleus.
7. the smallest unit of an element.

7. Science-related Career Highlights and Prospectives

1. Villars Institute Fellowship

Link: <https://villarsinstitute.org/>

As a Villars Fellow, you are eligible to participate in various courses run by partner institutions (such as Minerva University), go abroad for summits and symposiums, as well as join a community of life-long learners and like-minded individuals.

Application process: selection via a school application process.

2. IYNA – International Youth Neuroscience Association

Link: <https://www.youthneuro.org/>

IYNA is a youth-led, non-profit organisation that aims to connect, educate and inspire students to pursue the field of neuroscience. The IYNA provides many opportunities, such as the fully-online Introduction to Neuroscience summer course, themed speaker events, a global chapter system, and Journal that publishes original and research review work.

Application: depending on specific programmes (journal entries are open all year round, summer session deadlines at the beginning of each year).

3. Journal of Student Research

Link: <https://www.jsr.org/index.php/path>

The Journal of Student Research offers a global platform for students to publish their work, providing scholarly feedback through a double-blind review process to help authors refine their submissions and understand the publication process.

Application: depending on issue and volume. Check the website for updates.

4. Symposium for Young Scientists

Link: smn.fuw.edu.pl; <https://www.facebook.com/SMNFUW/>

Although this event is targeted at undergraduate and graduate students, the symposium offers a platform for students to showcase their research, engage with projects from various institutions, and an exciting networking opportunity.

Application: for both presenters and passive participants the registration (free) takes place during the summer, with the symposium itself in September.

8. Answers to Booklet Exercises

[5 - Science-related fun facts]

1. False
2. False
3. True
4. False
5. False
6. False
7. True
8. True
9. True
10. False

[6 – Crosswords]

Biology

Across

4. Cell

5. Mitochondria

6. DNA

7. Amino acids (one word)

9. Oxygen

Down

1. Photosynthesis

2. Genetics

3. Homeostasis

7. Artery

8. Cell

Chemistry

Across

1. Catalyst
5. Oxidation
6. pH
7. electron

Down

1. Covalent
2. Acid
3. Alkali
4. Molecule
6. proton
7. atom

Credits

- ❖ Ms Magdalena Strzelczak and Fine Art students

- ❖ Chemical Influencers Club students:
 - Y13 Maria Rutkowska
 - Y13 Nicola Stanisławska
 - Y12 Jan Stęczniewski
 - Y12 Katarzyna Kozak
 - Y12 Leopold Pik
 - Y11 Anna Zhukovskaya

- ❖ Natural Sciences student volunteers

- ❖ Natural Sciences Faculty