Engage Teacher Conference

Secondary free and accessible STEM resources showcase

Leading experts from the STEM sector are coming together to showcase their top free resources. Find inspiration for STEM enrichment that is easy to implement and supports you engage underrepresented audiences in science.

Rebecca Olajide & Peter Jeffrey-Bourne, Science Museum Group
Cristine Alcantara, The British Science Association
Ruby Seger-Bernard, The Royal Society
Delfi Tertzakian, Unplastify
Stewart Edmondson MA MBA BSc CEng FIET CMgr FCMI, UK Electronics Skills Foundation, Aston University

Engage Teacher Conference

Engage

Welcome, please be aware:

- Talks are recorded
- You can ask questions in the chat throughout
- There will be time for questions at the end

Engage

Science Museum Group

Rebecca Olajide
Learning Resources Producer
Peter Jeffrey-Bourne
Academy and Resources Developer

SCIENCE CAPITAL

- Engaging people with science is at the heart of the work we do at SMG.
- Science Capital is a concept that helps us to better understand why some people engage with science and why others think that science isn't for them.
- Science Capital is made up of...
  - What you know about science/STEM
  - What you do – different science related activities
  - Who you know who uses and talks about science
  - How you think and feel about science
- We don't want everyone to become scientists, but we want people to feel like science is something for them and something that they can do.
- Positive, meaningful experiences of science learning in early life will have a big impact in how children relate to science later in life.

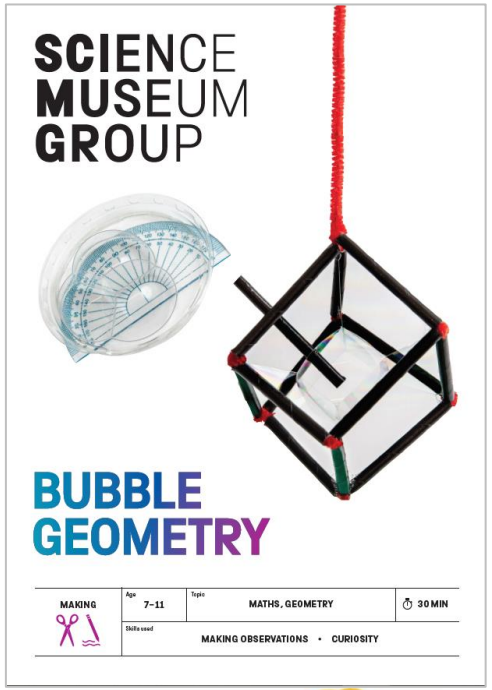
SCIENCE MUSEUM GROUP RESOURCES...

- Are shaped by science capital and wider cultural and STEM engagement research-informed best practice and learning outcomes
- Enable people to use – and recognise using – a wide range of STEM skills (e.g. making observations, communication, curiosity, asking questions, creative problem solving, finding and using evidence, teamwork, etc.)
- Invite and encourage people to investigate further and find out more
- Are intuitive to use, with simple and clear instructions, and use easily sourced, recycled, reusable or sustainable materials

HANDS-ON ACTIVITIES KEY FEATURES

Builds confidence and ownership (in adults)

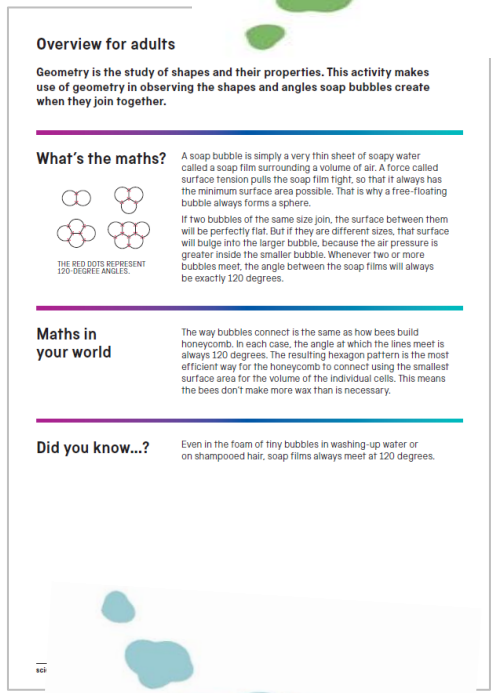
Builds confidence and ownership (easy to follow images etc)


SCIENCE MUSEUM GROUP

BUBBLE GEOMETRY

MAKING | Age 7–11 | Topic MATHS, GEOMETRY | 30 MIN

Skills used: MAKING OBSERVATIONS • CURIOSITY


Overview for adults

Geometry is the study of shapes and their properties. This activity makes use of geometry in observing the shapes and angles soap bubbles create when they join together.

What's the maths?

A soap bubble is simply a very thin sheet of soapy water called a soap film surrounding a volume of air. A force called surface tension pulls the soap film tight, so that it always has the minimum surface area possible. That is why a free-floating bubble always forms a sphere.

If two bubbles of the same size join, the surface between them will be perfectly flat. But if they are different sizes, that surface will bulge into the larger bubble, because the air pressure is greater inside the smaller bubble. Whenever two or more bubbles meet, the angle between the soap films will always be exactly 120 degrees.

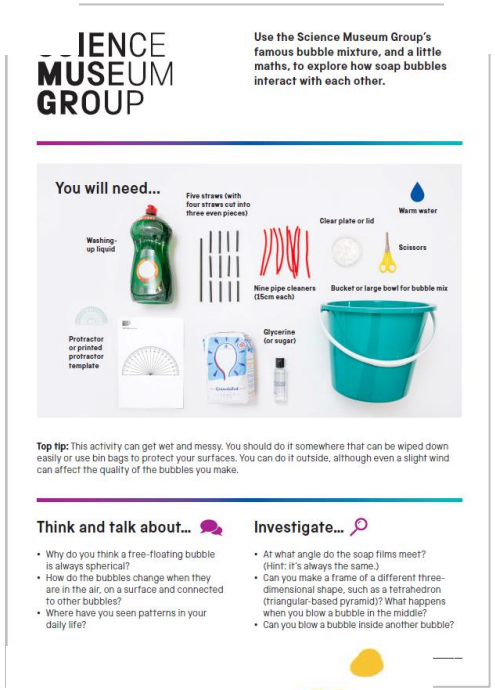
THE RED DOTS REPRESENT 120-DEGREE ANGLES.

Maths in your world

The way bubbles connect is the same as how bees build honeycomb. In each case, the angle at which the lines meet is always 120 degrees. The resulting hexagon pattern is the most efficient way for the honeycomb to connect using the smallest surface area for the volume of the individual cells. This means the bees don't make more wax than is necessary.

Did you know...?

Even in the foam of tiny bubbles in washing-up water or on shampooed hair, soap films always meet at 120 degrees.


SCIENCE MUSEUM GROUP

Use the Science Museum Group's famous bubble mixture, and a little maths, to explore how soap bubbles interact with each other.

You will need...

Washing-up liquid; Five straws (with four straws cut into three even pieces); Nine pipe cleaners (15cm each); Clear plate or lid; Warm water; Scissors; Bucket or large bowl for bubble mix; Protractor or printed protractor template; Glycerine (or sugar)

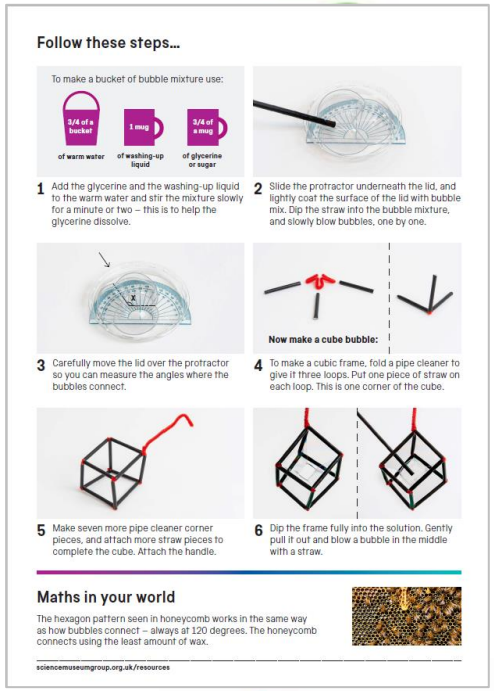
Top tip: This activity can get wet and messy. You should do it somewhere that can be wiped down easily or use bin bags to protect your surfaces. You can do it outside, although even a slight wind can affect the quality of the bubbles you make.

Think and talk about...

- Why do you think a free-floating bubble is always spherical?
- How do the bubbles change when they are in the air, on a surface and connected to other bubbles?
- Where have you seen patterns in your daily life?

Investigate...

- At what angle do the soap films meet? (Hint: it's always the same.)
- Can you make a frame of a different three-dimensional shape, such as a tetrahedron (triangular-based pyramid)? What happens when you blow a bubble in the middle?
- Can you blow a bubble inside another bubble?


Follow these steps...

To make a bucket of bubble mixture use:

3/4 of a bucket of warm water; 1 mug of washing-up liquid; 3/4 of a mug of glycerine or sugar

1 Add the glycerine and the washing-up liquid to the warm water and stir the mixture slowly for a minute or two – this is to help the glycerine dissolve.

2 Slide the protractor underneath the lid, and lightly coat the surface of the lid with bubble mix. Dip the straw into the bubble mixture, and slowly blow bubbles, one by one.

3 Carefully move the lid over the protractor so you can measure the angles where the bubbles connect.

4 To make a cubic frame, fold a pipe cleaner to give it three loops. Put one piece of straw on each loop. This is one corner of the cube.

Now make a cube bubble:

5 Make seven more pipe cleaner corner pieces, and attach more straw pieces to complete the cube. Attach the handle.

6 Dip the frame fully into the solution. Gently pull it out and blow a bubble in the middle with a straw.

Maths in your world

The hexagon pattern seen in honeycomb works in the same way as how bubbles connect – always at 120 degrees. The honeycomb connects using the least amount of wax.

sciencemuseumgroup.org.uk/resources

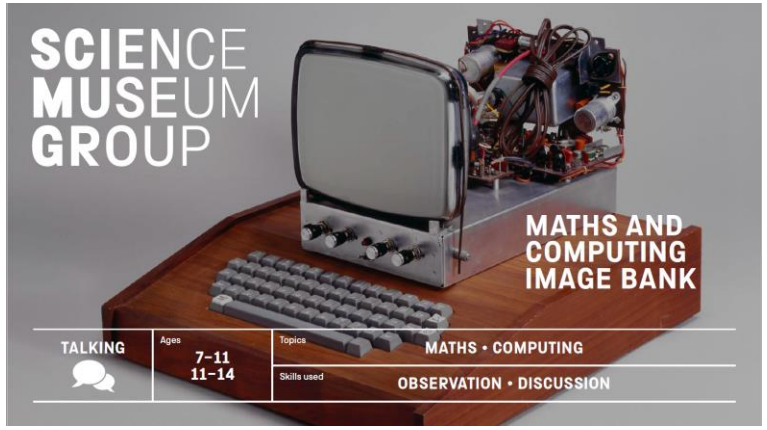
Highlights and develop skills

Links to everyday examples of STEM

Promotes science talk

Everyday examples of STEM

IMAGE BANKS: OVERVIEW



COVER PAGE

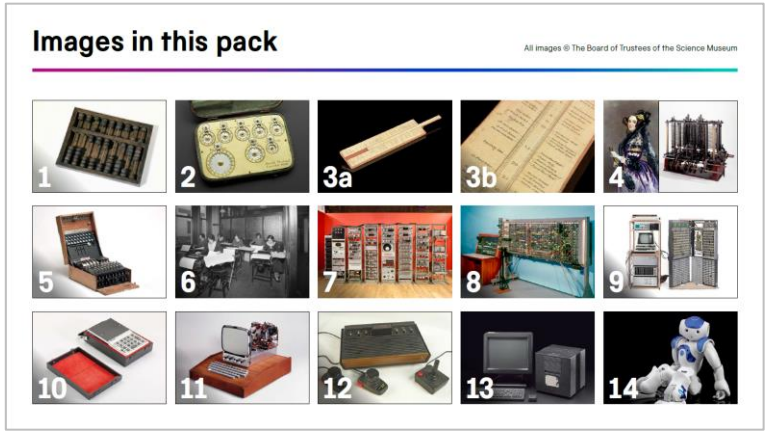
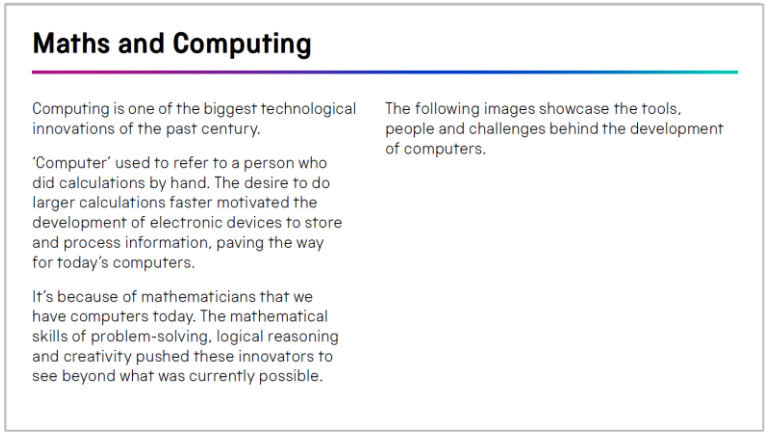


IMAGE BANK CONTENT OVERVIEW



INTRODUCTION & HOW TO USE

IMAGES

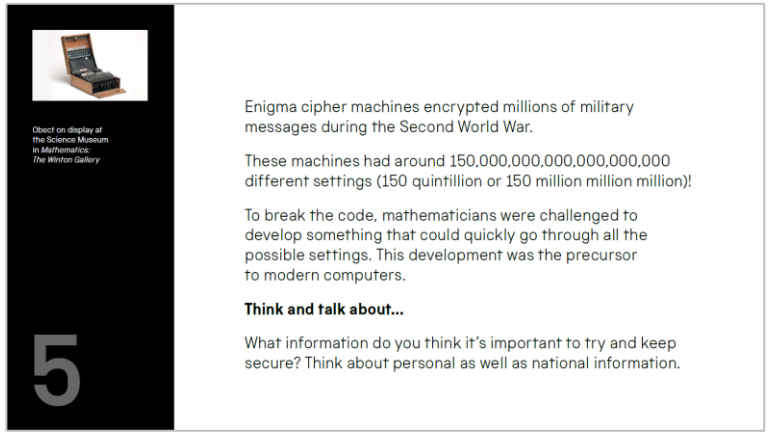
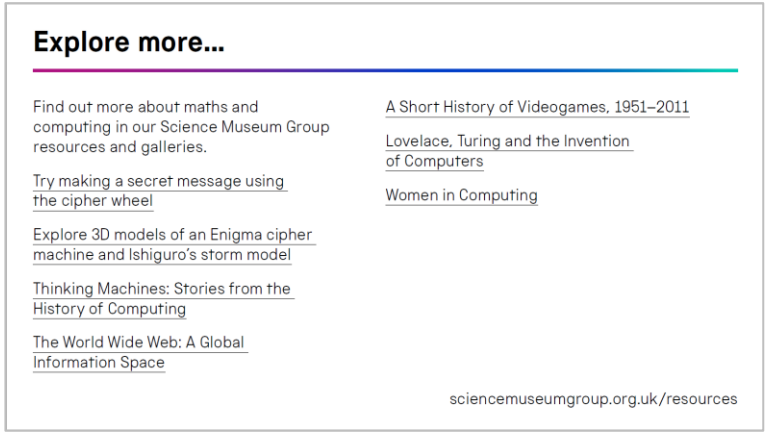


IMAGE INFORMATION & ACTIVITY



LINKS TO FURTHER INFORMATION

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The British Science Association - CREST Awards

Cristine Alcantara
Education Manager

Bronze, Silver or Gold

	 BRONZE	 SILVER	 GOLD
Typical age*	***11+ years*** typical age	***14+ years*** typical age	***16+ years*** typical age
Time commitment	***10+ hours of work***	***30+ hours***	***70+ hours***
Assessment	By ***any adult*** before submission	By the expert ***CREST Assessors***	By the expert ***CREST Assessors***
Key benefits	Provides a real-life experience of 'being' a scientist.	Can improve GCSE grades and increases interest in continuing in STEM education	Enhances UCAS personal statements and is well regarded by employers
Key stage (suggested)	England: KS3 / L1 Wales: KS3 / L1 Scotland: S1, S2 and S3 Northern Ireland: KS3	England: KS4 / L2 Wales: KS2 / L2 Scotland: S4, S5 and S6 Northern Ireland: KS4	England: KS5 / L3 Wales: KS5 / L3 Scotland: S6 Northern Ireland: KS5

crestawards.org

* All ages given are simply a guideline, choose the Award level you think is most suitable

CREST Awards impact report 2021/22

Students

- Enhance research, communication and teamworking skills
- Build independence and resilience
- Gain employability skills
- Improve GCSE grades
  - ❖ Improvement of half a grade in GCSE science; up to 2/3 of a grade for students eligible for FSM
- Gain confidence
- Develop their STEM identities

> ***(This project) has given me more confidence, as it is physical proof that you can achieve something.***
> George, student from Lighthouse School in Leeds

CREST Awards impact report 2021/22

Teachers

- Provide practical science activities that are linked to the national curriculum, so can be run in lessons
- Provide free resources plus additional support for schools who need it most
  - ❖ Engage network
  - ❖ Buddy scheme
  - ❖ Grants plus free CREST Awards

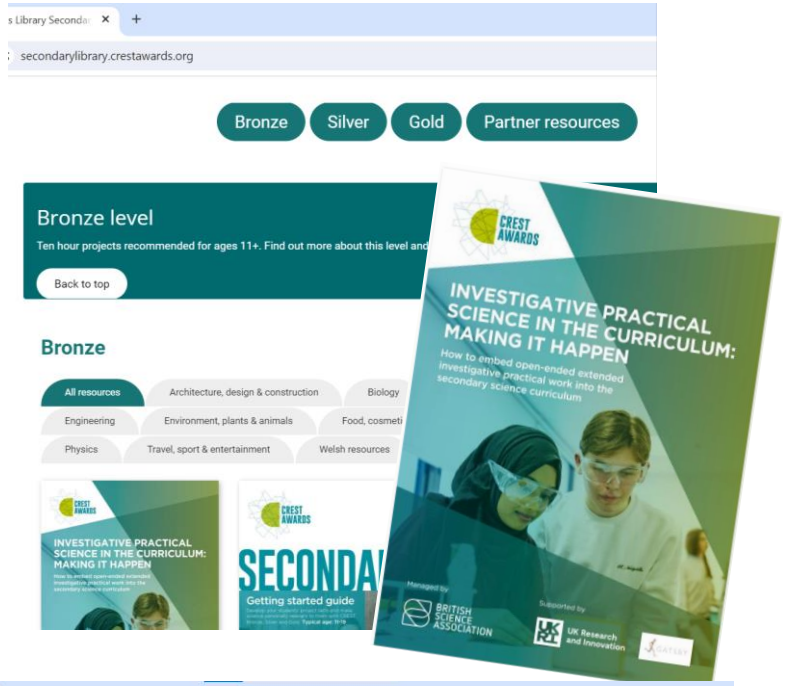
> ***I think it brings a new sense of curiosity and discovery to students who have not been afforded the chance to really engage in science.***
>
> Secondary school teacher, 'Machines of the future' pilot project participant

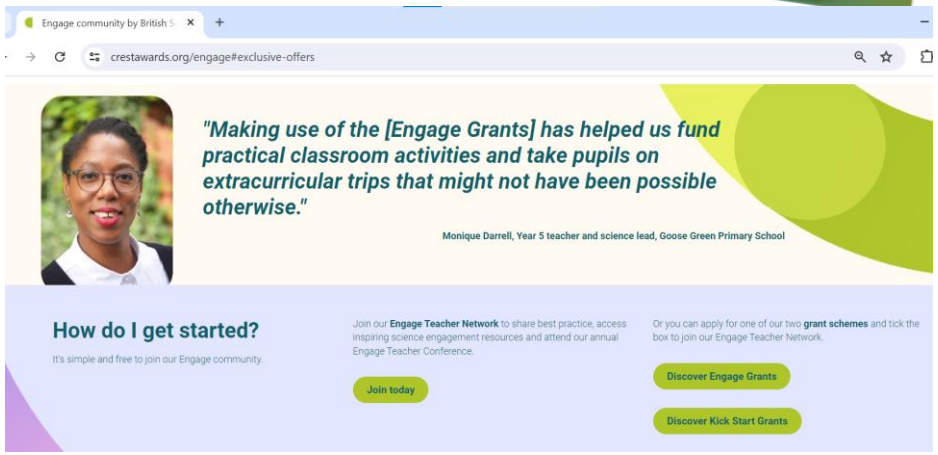
Next steps

- Resource library
  https://secondarylibrary.crestawards.org/

- Apply for an Engage grant in September
  https://www.crestawards.org/engage

- Get in touch with us
  crest@britishscienceassociation.org





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Royal Society - STEM resources and Partnership Grants

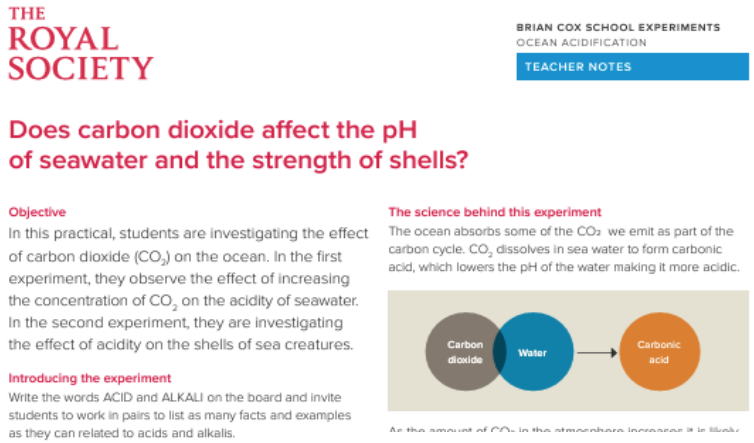
Ruby Seger-Bernard
Schools Engagement Officer

Brian Cox School Experiments

royalsociety.org/schoolexperiments

#BrianCoxSchoolExperiments

THE ROYAL SOCIETY



THE ROYAL SOCIETY

BRIAN COX SCHOOL EXPERIMENTS
OCEAN ACIDIFICATION
TEACHER NOTES

Does carbon dioxide affect the pH of seawater and the strength of shells?

Objective
In this practical, students are investigating the effect of carbon dioxide (CO_2) on the ocean. In the first experiment, they observe the effect of increasing the concentration of CO_2 on the acidity of seawater. In the second experiment, they are investigating the effect of acidity on the shells of sea creatures.

Introducing the experiment
Write the words ACID and ALKALI on the board and invite students to work in pairs to list as many facts and examples as they can related to acids and alkalis.

Introduce ocean acidification by showing students the video *What is Ocean Acidification?* from the University of Plymouth: https://youtu.be/L2bxwnm7JG4 (less than 2 minutes).

During the experiment
Discuss with the students the difference in ease and accuracy of using a pH meter compared with UI solution. You may also decide to try UI paper or even litmus paper to demonstrate the effectiveness of certain indicators. Students are unlikely to see any changes with litmus paper.

This is an activity that easily lends itself to having students design their own experiment if time allows.

Discussion points after the experiment
Ask students to prepare an 'elevator pitch' – give them one minute to explain what ocean acidification is and what the results of their experiment showed. Some students may want to prepare an elevator pitch on the limitations of the experiment.

The science behind this experiment
The ocean absorbs some of the CO_2 we emit as part of the carbon cycle. CO_2 dissolves in sea water to form carbonic acid, which lowers the pH of the water making it more acidic.

THE ROYAL SOCIETY

BRIAN COX SCHOOL EXPERIMENTS
GENOME EDITING AND PLANT BIOLOGY
STUDENT WORKSHEET

Does carbon dioxide affect the pH of seawater and the strength of shells?

Experiment 1: Investigating the effect of carbon dioxide on the pH of water

Your task is to investigate how carbon dioxide (CO_2) can affect the pH of seawater. This will give you an idea of whether increasing CO_2 emissions are likely to result in ocean acidification.

EQUIPMENT LIST

Materials for each group
- Salt
- Water
- 2 cups/beakers
- 1 lid
- 2 straws
- pH meter or Universal Indicator solution
- Measuring jug
- Tablespoon
- Stopwatch
- Where might we get a reliable and free source of CO_2?

SAFETY PRECAUTIONS
- Make sure to blow through the straw and to not suck the water up.
- Make sure to clean up any spills immediately and to keep the water well away from any electrical devices.
- If you break any glassware, make sure to tell your teacher immediately. Do not try to clean up broken glass yourself.

Method

1. The concentration of salt in seawater is approximately 3.5% (or 35,000 ppm), which equates to 35 grams per litre. Use tap water and the measuring jug to make 500 cm^3 (half a litre) of seawater. (Tip: 1 level tablespoon of salt is approximately 18 grams).

   I added _____ tablespoons of salt to _____ cm^3 of water.

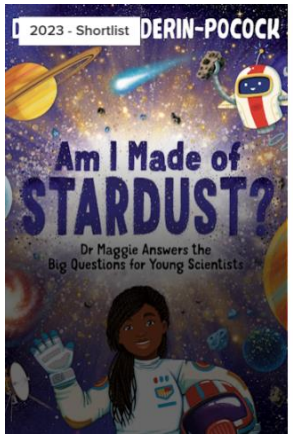
   (Step 1 may already have been done by the science technician)
2. Fill the two beakers with seawater (leave 1 – 2 cm space between the water and the lid) and save the rest for experiment 2.
3. Use the pH meter or Universal Indicator solution to record the pH of the water in the first beaker. Write this value into the first column of Table one.
4. Choose one person from your group who will do the task. Their job is to blow gently through a straw (adding CO_2) into the water for two minutes. Measure the pH of the water every 30 seconds and record your findings in Table one. Don't worry, you are allowed to breathe! Take small breaths when needed.
5. Repeat the experiment but this time cover the cup with a lid and insert the straw into the opening. Record your findings in Table two.
6. Answer the questions overleaf and be prepared to share your findings with the rest of the group.

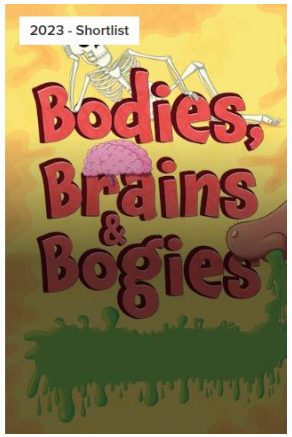
Other Royal Society resources for schools

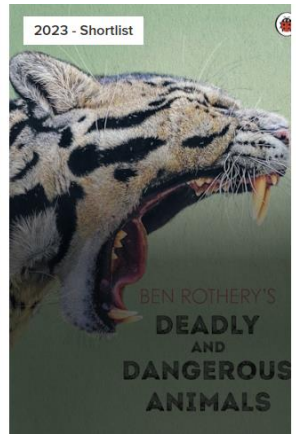
- Climate Change and Biodiversity Q&A cards and classroom posters

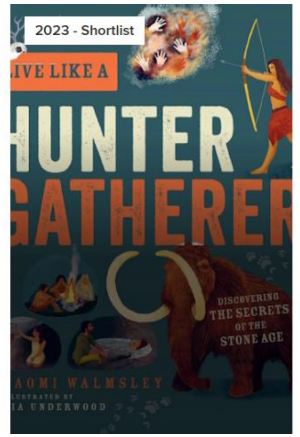
- Why Science is for me animation and posters

- Young People's Book Prize 2024









THE ROYAL SOCIETY

Partnership Grants Scheme

- The Partnership Grants scheme provides UK schools and colleges (aged 5 -18) up to £3,000 to work in partnership with STEM professionals from academia or industry to run a long-term investigative STEM project.
- The grant goes to the school and covers the equipment needed, with a small amount supporting teacher cover and CPD if needed.
- Information about the grants including map and case studies can be found on our website: www.royalsociety.org/grants/partnership-grants
- Training sessions are available via the website or email education@royalsociety.org for more information

THE ROYAL SOCIETY

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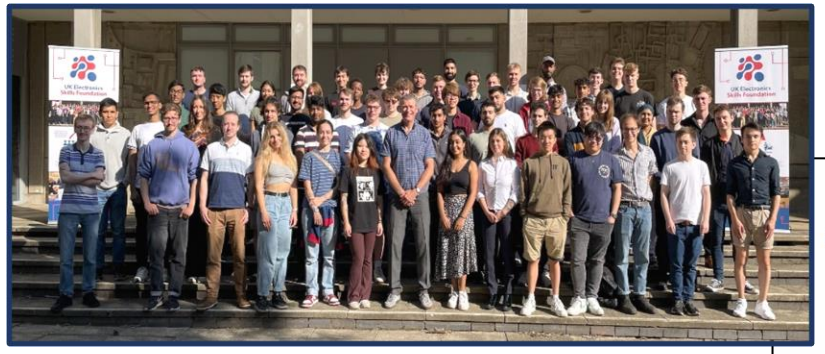
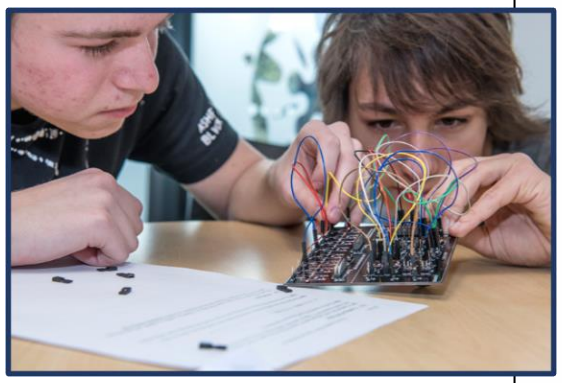
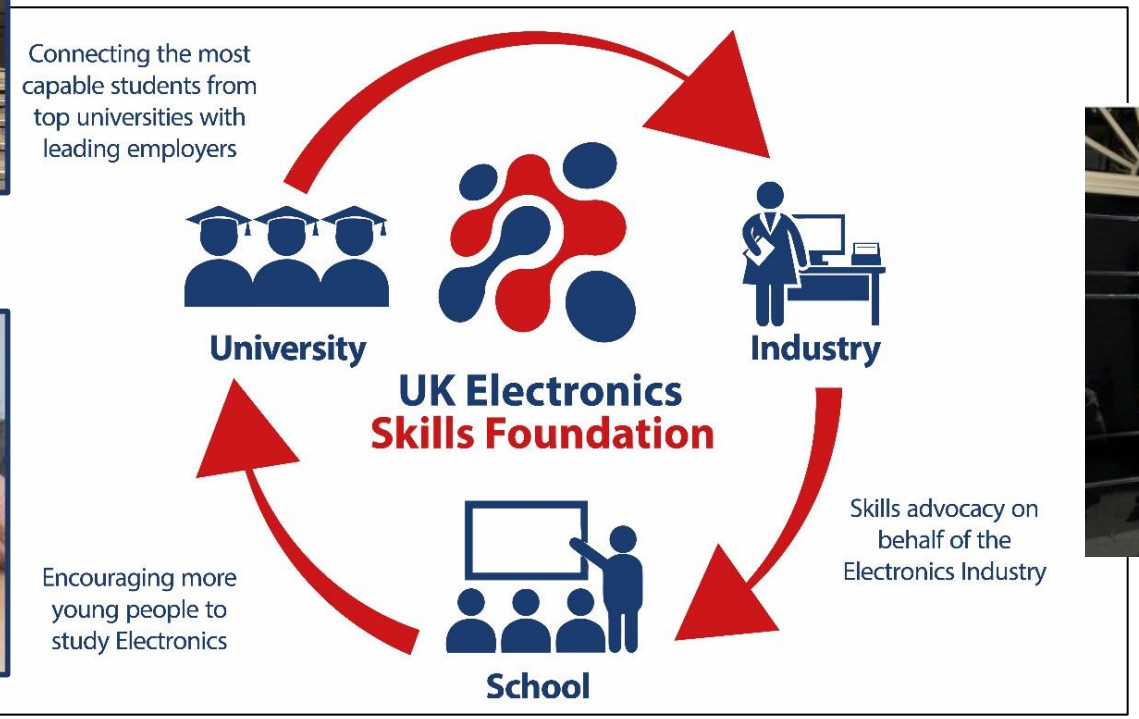
UK Electronic Skills Foundation "Electronics Everywhere"

Stewart Edmondson MA MBA BSc
CEng FIET CMgr FCMI
CEO, UK Electronics Skills Foundation
Visiting Professor, Aston University

Tackling the Skills Challenge in the UK's Electronics Industry







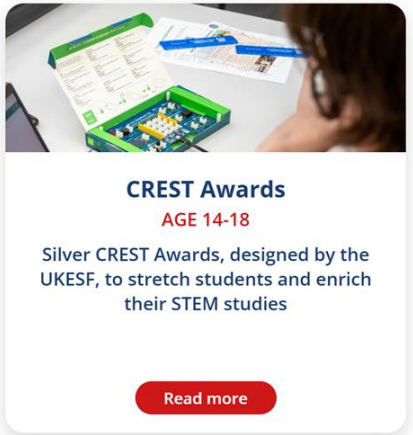
Founded in 2010, the UKESF is the only STEM organisation in the UK solely focused on Electronics. We are a multi award winning charity, and our purpose is to promote Electronics and semiconductors to young people and to encourage them to pursue study and careers in the industry.

UKESF – Summary of Schools Activities

UK Electronics Skills Foundation

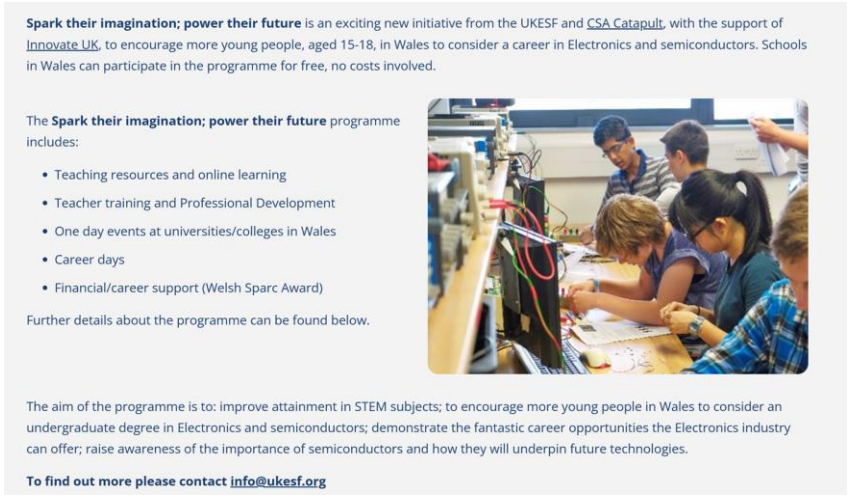
Classroom resources: Provided over 700 secondary schools/teachers with resources for teaching Electronics parts of Physics, and Computer Science. “Electronics Everywhere” and microcontrollers/Arduinos.

Crest Award. Silver level project in Electronics



Focus on ED&I: Over 400 girls (aged 15-18) participated in “Girls into Electronics” events in 2023.

Bespoke Programme: With a grant from Innovate UK, delivering a programme for schools (40) in Wales to promote EEE. Spark their Imagination



Spark their imagination; power their future is an exciting new initiative from the UKESF and CSA Catapult, with the support of Innovate UK, to encourage more young people, aged 15-18, in Wales to consider a career in Electronics and semiconductors. Schools in Wales can participate in the programme for free, no costs involved.

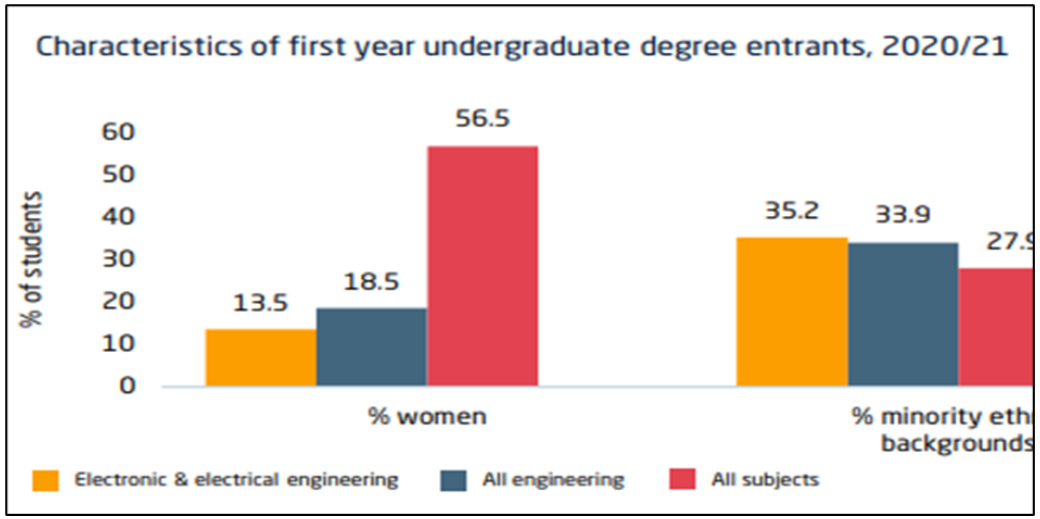
The **Spark their imagination; power their future** programme includes:

- Teaching resources and online learning
- Teacher training and Professional Development
- One day events at universities/colleges in Wales
- Career days
- Financial/career support (Welsh Sparc Award)

Further details about the programme can be found below.

The aim of the programme is to: improve attainment in STEM subjects; to encourage more young people in Wales to consider an undergraduate degree in Electronics and semiconductors; demonstrate the fantastic career opportunities the Electronics industry can offer; raise awareness of the importance of semiconductors and how they will underpin future technologies.

To find out more please contact info@ukesf.org



Electronics Everywhere

UK Electronics Skills Foundation

- Classroom resources that enables students to participate in hands-on and interactive activities that teach core Electronics concepts for Physics and Computer Science students.

- Developed by the UKESF in partnership with the University of Southampton.

    - More than 650 schools have used the resources.

    - 80% of teachers have rated the kits ‘excellent’ or ‘good’.

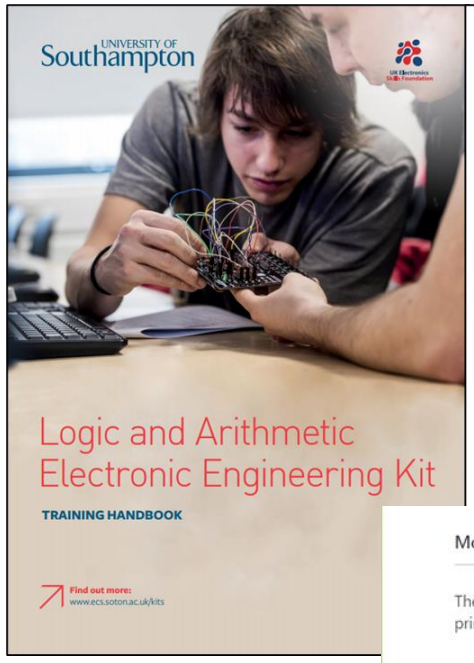
    - Overall reaction from pupils that used the kits was 95% positive, with 60% feeling more enthused about Electronics as a result!

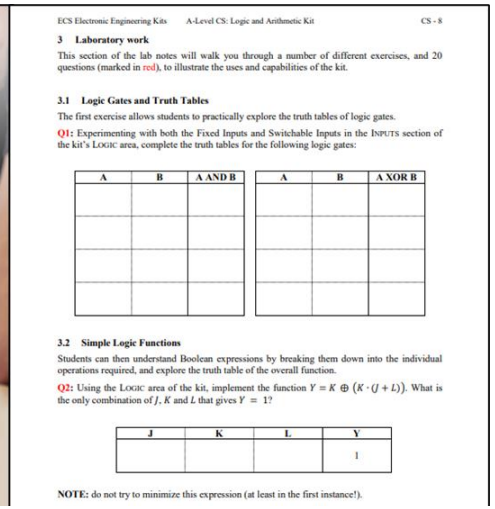
- The activities will support teachers to deliver required practicals as part of the curriculum in an engaging and exciting way, with an aim to improve attainment and inspire the next generation of Electronics engineers.

“By creating a physical product, my students were able to solve problems through experimentation and discussion, which they completely loved.”

Electronics Everywhere – Supporting Material

UK Electronics Skills Foundation




ECS Electronic Engineering Kits A-Level CS: Logic and Arithmetic Kit CS - 8

3 Laboratory work

This section of the lab notes will walk you through a number of different exercises, and 20 questions (marked in red), to illustrate the uses and capabilities of the kit.

3.1 Logic Gates and Truth Tables

The first exercise allows students to practically explore the truth tables of logic gates.

Q1: Experimenting with both the Fixed Inputs and Switchable Inputs in the INPUTS section of the kit's LOGIC area, complete the truth tables for the following logic gates:

A	B	A AND B

A	B	A XOR B

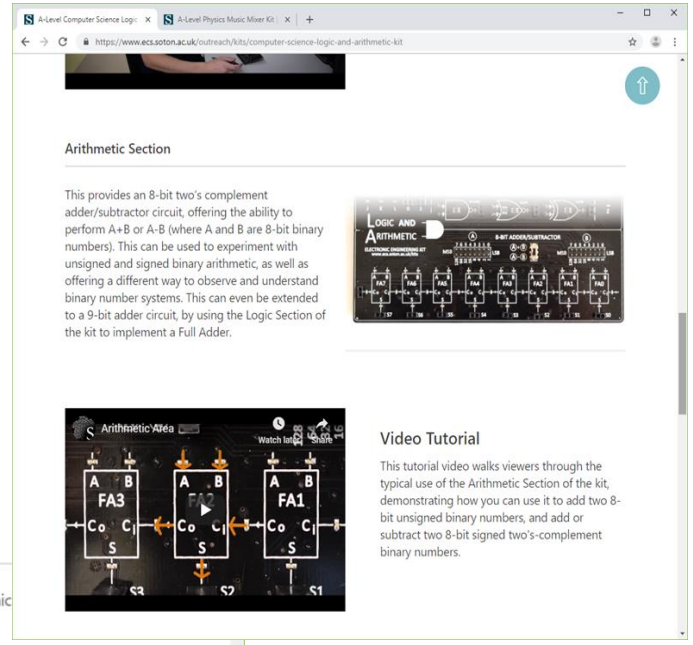
3.2 Simple Logic Functions

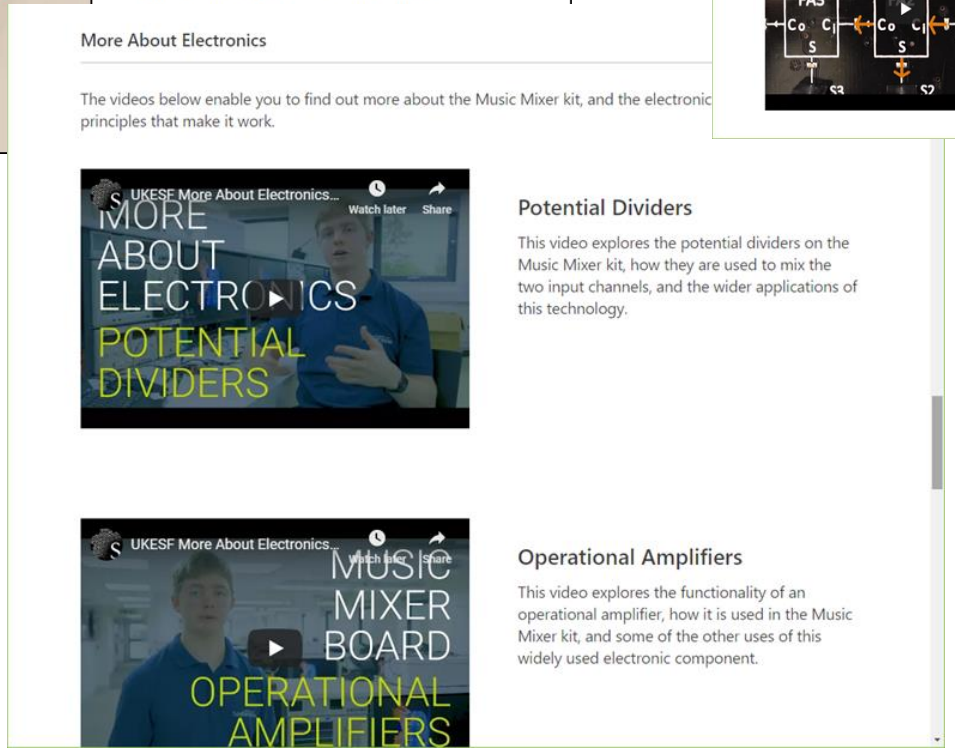
Students can then understand Boolean expressions by breaking them down into the individual operations required, and explore the truth table of the overall function.

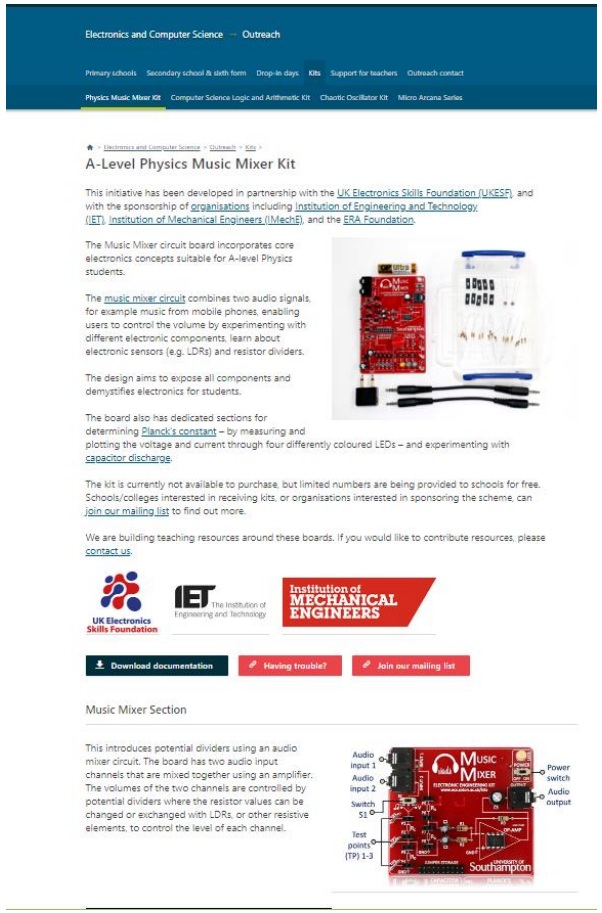
Q2: Using the LOGIC area of the kit, implement the function $Y = K \oplus (K \cdot (J + L))$. What is the only combination of J, K and L that gives $Y = 1$?

J	K	L	Y
			1

NOTE: do not try to minimize this expression (at least in the first instance!).

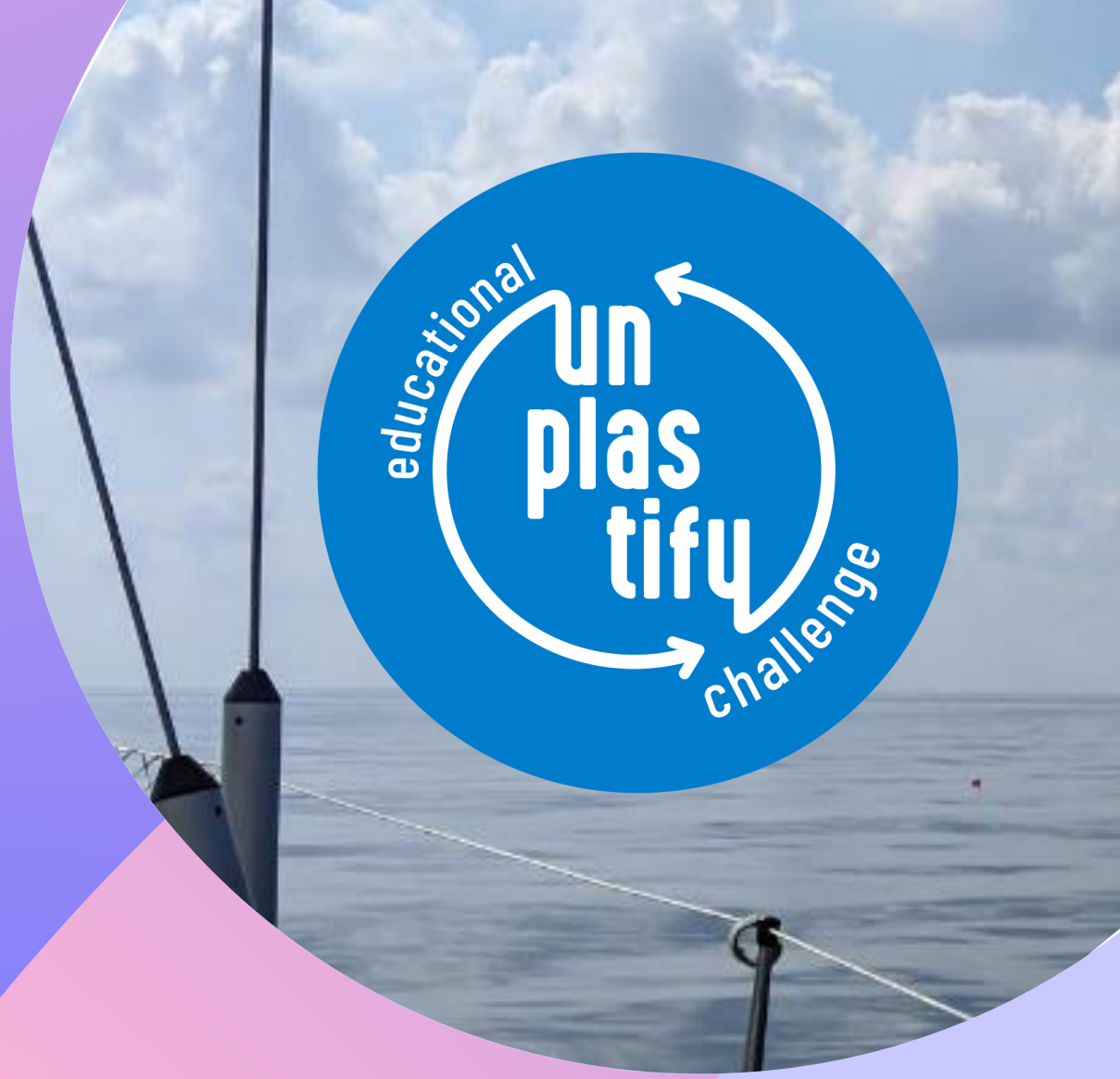






Engage

Unplastify Challenge for School



Delfi Tertzakian
Education Coordinator

UNPLASTIFY VISION

AN UNPLASTIFIED WORLD IS POSSIBLE AND NECESSARY.

A world in which we use plastic only for durable products, in which we don't use an indestructible material for single-use items, in which we consider negative externalities as real costs.

A world with sustainable habits, responsible production and clean seas is possible and necessary.

UNPLASTIFY CHALLENGE FOR SCHOOLS

10th EDITION

An international project-based educational program designed to empower 15 & 16 years-olds to ideate and develop their own unplastifying ideas and become true changemakers.

PEDAGOGICAL FRAMEWORK

01 PROJECT BASED LEARNING

02 CHANGEMAKERS SKILLS

03 AGILE AND DESIGN THINKING

DURATION
3 months (Sept-Nov)

FORMAT
Virtual

TIME
2-4 weekly hours

COST
300USD contribution
**Public schools are exempt*

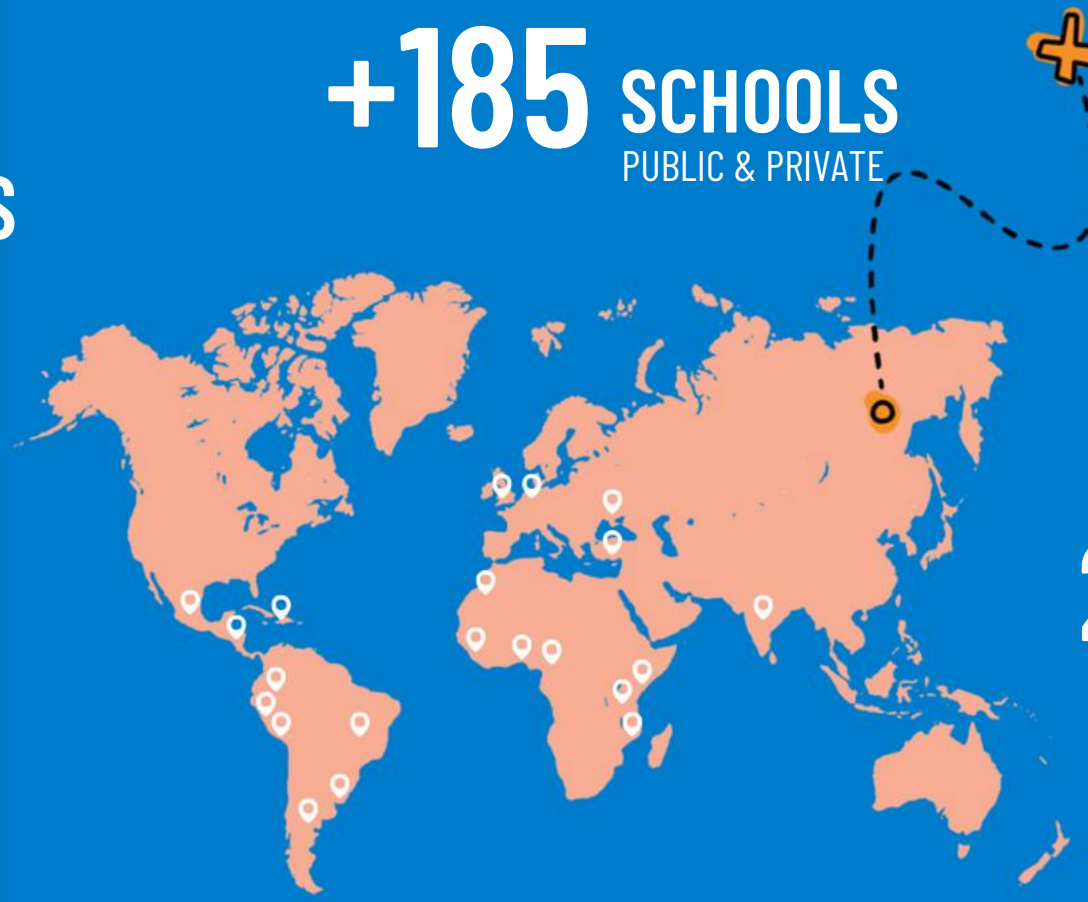
Project supported by Lindblad Expeditions-National Geographic Fund

TRACK RECORD 2019-2024

9 UCS EDITIONS

+185 SCHOOLS
PUBLIC & PRIVATE

+2.150 YOUNG PARTICIPANTS
+16.750 TALK ATTENDEES



22 COUNTRIES

NEXT STEPS

How is the **inscription process**

INSCRIPTION OPEN

1. Complete the **Registration Form**. You have time until Sept-4th, 2024.
   **Bear in consideration you must have your school's authorization.*
2. You will receive an **email** from the Unplastify team confirming your registration and stating next steps and details for payment (if applicable).
3. Join the **Onboarding** to know everything about the Challenge and how to navigate it with your students.
4. **Get ready** for the adventure!

If you have any questions, don't hesitate to contact us to education@unplastify.com

Unplastify.com | @unplastify.ed

Engage Teacher Conference

Thank you

Science Museum Group:
SMGacademy@sciencemuseum.ac.uk
Learning Resources: sciencemuseumgroup.org.uk/resources
Academy courses: sciencemuseumgroup.org.uk/academy

The Royal Society:
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