Royal Academy of Engineering

THIS IS ENGINEERING

OUR EXISTENCE

Teacher's guide

These resources aim to give students the opportunity to investigate the science, technology, engineering and mathematics (STEM) involved in living in extreme environments.

TEACHER'S GUIDE

INTRODUCTION TO THE RESOURCES

The engineering our existence STEM resources are aimed at key stage 3 pupils and could be used as part of the curriculum, in STEM clubs or as a drop down activity day.

The resources explore how different indigenous populations have used engineering to allow them to live in extreme environments and what we can learn from these solutions.

They also explore some modern engineering solutions to living in extreme environments.

Each resource has a copy printed as a brochure with a notes for teacher's section in the back (remember to remove any answer pages before copying for students!)

All the resources are also available on our website. The resources can be used however you wish, but some initial explanation and guidance is given in this teacher's guide.

Published: September 2016

Available to download from: **https://stemresources.raeng.org.uk**

THANK YOU

This STEM teaching and learning resource has been developed by the Royal Academy of Engineering as part of its national **Connecting STEM Teachers** (CST) programme.

CST is a support network for teachers across all STEM subjects ensuring they have the knowledge and confidence to engage a greater number and wider spectrum of school students with STEM. The programme operates across all regions of England, and in Scotland, Wales and Northern Ireland.

DESERT

Explanation:

This resource explains how an indigenous population has created an engineering solution to the problems they encounter in extreme heat, including solar power and traditional desert dress.

CURRICULUM MAP:

ACTIVITY	TOPIC	NATIONAL CURRICULUM
Activity 1	*Science*	Energy changes and transfers Light waves
Activity 2	*Design and technology*	Design Make Evaluate
Activity 3	*Science*	Experimental skills and investigation Current electricity
	Design and technology	Design Make Evaluate Technical knowledge
Stretch and challenge	*Computing*	Understanding simple Boolean logic and some of its uses in circuits

Time:

The resource is adaptable in terms of the time required, but as a guide you should allow two hours to cover all activities fully. Extra time will be needed to cover stretch and challenge activities.

Resources included:

- Solar panels
- Capacitors
- LEDs
- Diodes

Resources required:

- Wires
- Torch
- Netting or meshed fabric
- Various materials to build fog catcher

MONSOON

Explanation:

This resource explains how an indigenous population has created an engineering solution to the problems they encounter in extreme rain. This resource also explains the formation of clouds as well as investigating tardigrades, which are able to survive in many extreme environments.

CURRICULUM MAP:

ACTIVITY	TOPIC	NATIONAL CURRICULUM
Activity 1	*Geography*	Physical geography relating to: geological timescales and plate tectonics; rocks, weathering and soils; weather and climate, including the change in climate from the Ice Age to the present; and glaciation, hydrology and coasts
	Science	Earth and atmosphere
Activity 2	*Design and technology*	Design Make Evaluate Technical knowledge
Stretch and challenge	*Design and technology*	Evaluate Technical knowledge
Activity 3	*Design and technology*	Design Make Evaluate Technical knowledge
Activity 4	*Science*	Experimental skills and investigation Cells and organisation

Time:

The resource is adaptable in terms of the time required, but as a guide you should allow at least three hours to cover all activities fully. Extra time will be needed to cover stretch and challenge activities.

Resources included:

- Printed circuit board (PCB)
- BC548 transistor
- Humidity sensor
- 1KΩ resistor
- 100Ω resistor
- 470Ω resistor
- Standard LED
- 5K potentiometer
- Battery connector

Resources required:

- Beakers
- Water
- Petri dish
- Black paper or card
- Matches or Bunsen burner and splints
- Zip lock bag
- 9V battery
- Soldering iron
- Microscopes and slides
- Kettles
- Ice cubes
- Moss

SUB ZERO

Explanation:

This resource explains how an indigenous population has created an engineering solution to the problems they encounter in extreme cold, including building safe shelters and keeping warm.

CURRICULUM MAP:

ACTIVITY	TOPIC	NATIONAL CURRICULUM
Activity 1	*Mathematics*	Develop fluency Reason mathematically Number Algebra
Stretch and challenge 1	*Mathematics*	Develop fluency Reason mathematically Number Algebra
Activity 2	*Science*	Experimental skills and investigation Analysis and evaluation
Stretch and challenge 2	*Design and technology*	Evaluate
Activity 3	*Science*	Experimental skills and investigation Energetics

Time:

The resource is adaptable in terms of the time required, but as a guide you should allow two hours to cover all activities fully. Extra time will be needed to cover stretch and challenge activities.

Resources included:

- Reusable hand warmers
- Disposable hand warmers

Resources required:

- Toothpicks
- Jelly sweets
- Graph paper

Royal Academy of Engineering

The Royal Academy of Engineering is harnessing the power of engineering to build a sustainable society and an inclusive economy that works for everyone.

In collaboration with our Fellows and partners, we're growing talent and developing skills for the future, driving innovation and building global partnerships, and influencing policy and engaging the public.

Together we're working to tackle the greatest challenges of our age.

What we do

Talent & diversity

We're growing talent by training, supporting, mentoring and funding the most talented and creative researchers, innovators and leaders from across the engineering profession.

We're developing skills for the future by identifying the challenges of an ever-changing world and developing the skills and approaches we need to build a resilient and diverse engineering profession.

Innovation

We're driving innovation by investing in some of the country's most creative and exciting engineering ideas and businesses.

We're building global partnerships that bring the world's best engineers from industry, entrepreneurship and academia together to collaborate on creative innovations that address the greatest global challenges of our age.

Policy & engagement

We're influencing policy through the National Engineering Policy Centre – providing independent expert support to policymakers on issues of importance.

We're engaging the public by opening their eyes to the wonders of engineering and inspiring young people to become the next generation of engineers.

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Registered charity number 293074