Materials for innovative teachers

This booklet outlines the resource materials at the heart of the ENAGAGE project.
It is intended to help you to plan for the use of these award winning materials within your school science curriculum.

The ENGAGE materials are designed to include both enquiry skills and science content

Skill

Topic

physics	Forces
	Electromagnetism
	Energy
	Waves
chemistry	Matter
	Reactions
	Earth
biology	Organisms
	Ecosystem
	Genes

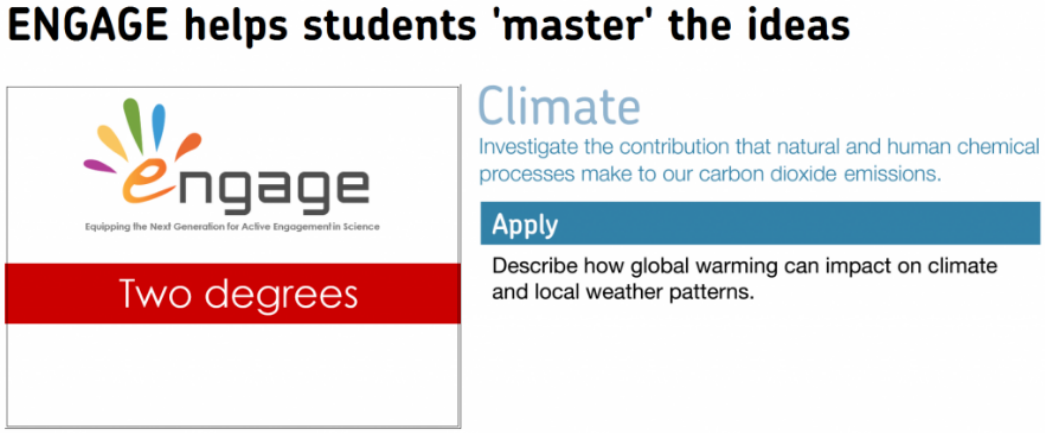
KS3 Science Syllabus and engage

ENGAGE co-developed the AQA KS3 Science Syllabus and our materials are designed with the same philosophy of teaching for real understanding.

The learning objectives in the Syllabus aim at 'mastery' which has two dimensions, Know and Apply.

First students **Know** the conceptual knowledge and then become able to **Apply** the ideas to unfamiliar situations – the hallmark of understanding.

ENGAGE targets Apply – its realistic contexts provide students with critical practice in deepening their understanding.



There are three different types of ENGAGE resource.

inquiry novice

apply content
apply skills

40-60 mins

topical

apply content
teach skills

1-2 lessons

sequence

inquiry expert

apply content
apply skills
independently
(guided inquiry)

several lessons

project

Lessons

Physics

Text neck

New research suggests that smart phone use is seriously damaging our necks. Should use smart phone less to prevent neck damage?

Skill: devise questions
Topic: forces

Appliance science

Students have to decide how to cut their personal electricity consumption – do they go for a shorter shower or banish blow-dries?

Skill: justify opinions
Topic: energy

Solar roadways

Can we believe the claims about this new technology; are solar roadways worth funding?

Skill: critique claims
Topic: energy

Ban the beds

In preparation for a summer holiday many people turn to sunbeds to top up their tan but could this habit be endangering their life?

Skill: critique claims
Topic: waves

What does the fox say?

Can we use the science of sound waves to interpret animal sounds?

Skill: critique claims
Topic: waves

Lessons

Chemistry

Life on Enceladus

Evidence from Cassini, a robot spacecraft, suggests that there are oceans of hot water on Saturn's icy moon, Enceladus. Might the oceans be home to alien life?

Skill: draw conclusions
Topic: matter

Death to diesel?

Major car manufacturers have fitted software to diesel cars to cheat exhaust emissions tests. Can students persuade car buyers not to buy diesel cars?

Skill: communicate ideas
Topic: reactions

Car wars

Increased carbon dioxide emissions have led to huge financial incentives to buy alternatives to petrol engines – but which car is best?

Skill: examine consequences
Topic: earth

Big bag ban

Will degradable plastic bags solve the problems caused by ordinary plastic bags?

Skill: examine consequences
Topic: earth

Sinking island

Students decide whether humans are to blame for climate change. Should the biggest polluters pay for land for vulnerable islanders to escape to?

Skill: draw conclusions
Topic: earth

Eat insects

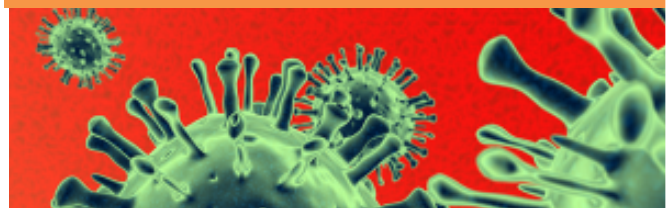
Farming large animals uses precious resources. Can you persuade people to swap meat for insects?

Skill: communicate ideas
Topic: earth

Lessons

Biology

Attack of the giant viruses



Newspapers report that scientists have discovered a giant 30 000 year old virus still alive under the permafrost - could this wipe out the human race?

Skill: interrogate sources
Topic: organisms

Grow your own body

Will it soon be possible to build new organs in a dish from cells taken from the patient's own body?

Skill: critique claims
Topic: organisms

Ban cola?

Is there enough evidence for causal links between sugar consumption, obesity and disease? Should we ban sugary drink sales to under-18s?

Skill: critique claims
Topic: organisms

Invasion!

Common ragweed is an invasive plant which is spreading across Europe. Should we control it by introducing non-native beetles?

Skill: examine consequences
Topic: ecosystems

Chocolate money

A chocolate company needs money to research decreasing yields: Can you work out a deal where all parties will benefit?

Skill: justify opinions
Topic: ecosystems

GM decision

The growing of GM crops across the world is set to increase, are they a risk to health?

Skill: estimate risks
Topic: genes

Lessons

Biology

Ebola/Zika

Would you trial a new vaccine? What are the risks and benefits?

Skill: estimate risks
Topic: genes

Three parents

Would you recommend a new procedure which creates babies with the DNA of 3 people in order to help women to have a healthy baby?

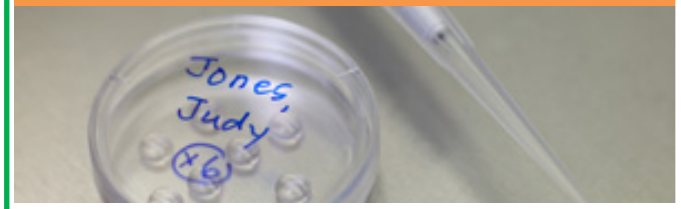
Skill: use ethics
Topic: genes

Take the test?

Genetic tests can be used to determine whether a person is a carrier of a genetic condition – but is having a test always the best thing to do?

Skill: devise questions
Topic: genes

Making decisions



What could parents do if they want children and are carriers of beta thalassaemia major? Should they consider IVF and the pre-implantation genetic diagnosis?

Skill: examine consequences
Topic: genes

Sequences

Man or machine

Are improvements in sport down to the athlete or the engineering? In this activity students apply their knowledge of frictional forces to design a racing bicycle to help team GB smash more records on the cycling track. After a ruling body claims their design gives an unfair advantage they will learn how to critique a claim in order to decide if they agree with the decision.

Skill: critique claims
Topic: forces: contact forces

Electronic cigarettes

Campaigners in support of ban point out that nicotine from e-cigarettes may contribute to heart disease and cancers, as well as damaging the brains of developing foetuses. In this activity students decide whether they support a ban. They apply their knowledge of particle theory to decide whether exhaled nicotine can reach non-vapers nearby, and then learn to judge risks to decide whether the benefits of a ban on indoor vaping outweigh the risks.

Skill: estimate risks
Topic: matter: particle model

Two degrees

UK winters are getting wetter and flooding is a common threat in many parts of the country. Scientists believe climate change may have caused this extreme weather. In this sequence students apply their knowledge to create an apocalyptic weather report. Then they learn the skill of examining consequences, and judge solutions for limiting the temperature rise to 2 degrees.

Skill: examine consequences
Topic: earth: climate

Sequences

To frack or not?

Whilst some countries in Europe have banned fracking following concerns that substances used in the process pollute water, others want to exploit shale gas reserves to provide new – and cheap – sources of natural gas. In this activity, students decide whether they support a ban on fracking. They apply their knowledge of the properties of rocks to decide whether substances from fracking can get into water, and learn how to justify opinions.

Skill: justify opinions
Topic: earth: earth structure

Vitamin D

Rickets and other bone diseases in young people have risen 400%, Some scientists are recommending teenagers take vitamin D supplements, particularly in autumn and winter. The activity teaches students how to analyse patterns in data, so they can calculate their vitamin D intake from food and the sun and come to an informed decision.

Skill: analyse patterns
Topic: organisms: digestion

Animal testing

In this activity students are asked to decide whether they agree that animal testing should be banned. They apply their knowledge about how asthma affects the gas exchange system to examine evidence and decide if animal testing is essential to developing new asthma drugs. They also learn about how to use ethical thinking to make difficult decisions and study different ethical viewpoints.

Skill: use ethics
Topic: organisms: breathing

Projects

Exterminate

Mosquitoes are the world's most dangerous killer. The diseases they transmit; malaria, Zika and dengue fever, cause more than a million deaths per year. Some scientists have suggested exterminate all dangerous mosquito species. One method is to release genetically modified (GM) male mosquitoes which prevent further breeding. In this project, students investigate whether exterminating mosquitoes is a good idea, using scientific knowledge about interdependence.

Skills: interrogate sources, estimate risk, use ethics, justify opinions and communicate ideas
Topic: ecosystems: interdependence

Eco-phone

As the number of smartphone users worldwide exceeds 2 billion, and as users update their devices with ever-increasing frequency, there are growing concerns about the impacts of smartphone manufacture and disposal on the environment and human health. In this activity, students use knowledge about Earth resources, as well as applying their working scientifically skills, to work out how to persuade phone manufacturers to make eco-friendly smart phones from sustainable materials.

Skills: interrogate sources, critique claims, analyse patterns, examine consequences and communicate ideas
Topic: earth: earth resources

What people are saying

- Really happy to see resources that support the explicit teaching of skills like ‘discussing risk’. Really effective way of developing appreciation of application of science in the real world.
- Thanks for this thrilling activity. My students discovered the medical, ethical, sociological and technical aspects all together and they discuss in a very lively way almost forgetting the break.
- It really starts pupils thinking about science in a wider and ethical context.
- I have yet to download an activity with which I was disappointed.
- Students were more enthused and had to ‘think harder’ as they were applying knowledge to a new concept.
- I am excited to have found something up to date and fresh to engage my students with issues that are happening in science now.
- I thought the resources were well structured and it got my students to think about what they would do in this situation and discuss their opinions.
- They actually use science to solve problems in a real life situation which means the pupils see the point.
- They were able to criticise arguments and form their own opinion based on facts.

Equipping the Next Generation
for Active Engagement in Science

engage

The ENGAGE project is part of the EU Science in society agenda to promote more Responsible Research and Innovation' (RRI).

ENGAGE's aim is to help teachers support students on socio-scientific issues and how to apply inquiry skills to form evidence based opinions on real-life scenarios.

The ENGAGE resources are freely accessible at www.engagingscience.eu