University of BRISTOL

CLASSICS FOR ALL
Championing Classics in Schools

THE SCIENCE OF STORIES

Myths and materials to enhance science capital at Key Stage 3

HOW TO USE THESE RESOURCES

The Science of Stories project invites teachers and pupils to use a selection of ancient classical myths as a way to ignite curiosity, develop 'science capital,' and deepen understanding of key scientific concepts. Students are encouraged to engage with the science through storytelling, practical demonstrations, abstract thinking, debate, and creative exercises.

An interactive pdf that can be used as a digital version of this book, plus supplementary materials (including videos, experiments, lesson plans, quizzes, and more), can be found on our website: **www.bristol.ac.uk/classics/hub**

These materials can be used in science lessons, science and STEM clubs – and they are also ideally suited for use by gifted and talented groups, debate groups, storytelling societies, and classics clubs. They can be used in a variety of ways. They work well as stand-alone activities, such as warm-ups and starters; as introductions to new topics; and as consolidation and revision exercises. They can be used as short activities, as part of a class or club session; or extended to fill a whole lesson.

They are aimed primarily at KS3 pupils studying the National Curriculum for Science, but some activities are also suitable for pupils at KS2 and GCSE.

The material requires no special preparation, and teacher notes are included for each topic. The big questions in each section work well when printed onto A4 and distributed across tables at the start of a class, encouraging pupils to debate and discuss as they settle; they have 60 seconds to work together to formulate an answer to the 'big question' on their table.

Each story and topic includes: a story, KS3 curriculum links, teacher notes, the big questions, and pupil activities.

THE SCIENCE OF STORIES

The success of teaching science through stories in schools is well established (e.g. **www.sciencethroughstory.com** and **www.stem.org.uk/teaching-science-through-stories**) but most resources are targeted at KS2. The Science of Stories project builds upon these successful initiatives by offering a range of activities suitable for KS3. It also introduces the concept that storytelling can be understood as a technology in its own right, and with its own 'science' **(narratology)** that explains how certain stories make us feel and react in predictable ways.

These resources guide pupils to develop a deeper understanding of a selection of scientific ideas in the subject disciplines of **biology, chemistry** and **physics**. They also encourage pupils to **see the connections between these subject areas** and become more aware of some of the **big ideas** underpinning scientific knowledge and understanding.

The stories and activities help pupils to relate scientific explanations to phenomena in the world around them and start to use abstract ideas to **model, develop, evaluate,** and **communicate** scientific theories and explanations.

They also show how **scientific ideas have developed historically.**

Each story and activity includes prompts towards **working scientifically** – particularly in evaluating risks; making predictions using scientific knowledge and understanding; selecting and planning the most appropriate types of scientific enquiries to test predictions; paying attention to objectivity.

www.gov.uk/government/publications/national-curriculum-in-england-science-programmes-of-study/national-curriculum-in-england-science-programmes-of-study#key-stage-3

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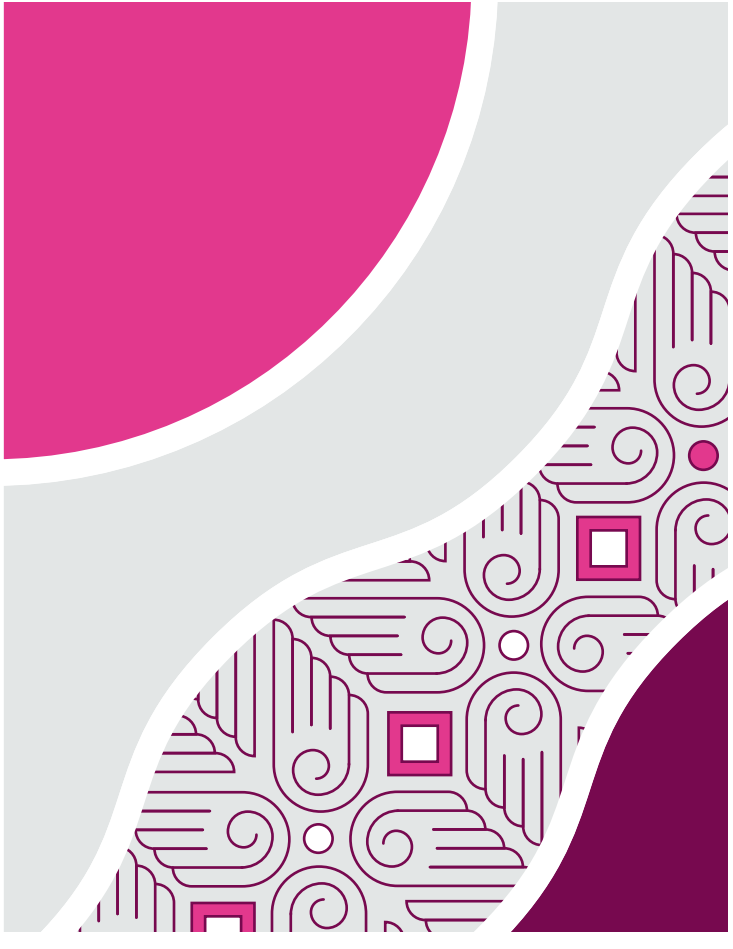
ICARUS THE STORY

A long, long, time ago in the ancient island kingdom of Crete there lived the world's greatest scientist. His name was Daedalus, and he lived on the island with his young son, Icarus. Because he was such a great scientist, powerful leaders from across the world tried to persuade Daedalus to come and work for them. But king Minos, ruler of Crete, didn't want to lose Daedalus to a rival ruler. So he had Daedalus design an ingenious prison tower from which escape was impossible. And then he locked up both Daedalus and Icarus inside. But Daedalus, determined to escape, hatched a plan ...



Minos allowed him to have a good supply of candles so that he could keep working on his scientific inventions even when it was dark. Minos also allowed him a good supply of food, which Icarus liked to share with the birds – who were now his only friends and playmates.

Taking inspiration from the birds, who could freely come and go from the tower as they pleased, Daedalus built human-sized bird wings for himself and for his son, using the candle wax to stick the feathers together.

As they were about to test the wings for the very first time, Daedalus gave this warning to Icarus: 'Keep your wings dry, my boy, and don't fly too low or too close to the sea. But make sure you don't fly too high, or too close to the sun. The heat will melt the wax holding your feathers in place and your wings will be useless.'

Daedalus and Icarus flapped their arms and soared up into the sky. They were flying like birds!

In his joy and excitement, Icarus flew higher and higher. And ever closer to the sun. The wax on his wings began to melt and one by one the feathers peeled away. With no feathers to support his weight, Icarus fell. Down, down, down into the sea, where he was swallowed up by the waves.

Adapted from Ovid, *Metamorphoses 8*
(c.1st century CE = 2,000 years ago)

ICARUS THE SCIENCE

KS3 curriculum links

Biology

- The structure and functions of the human skeleton, to include support, protection, movement
- Biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles
- Differences between species (mammals and birds)
- Natural selection and adaptation

Chemistry

- The properties of the different states of matter (solid, liquid and gas)
- The properties of materials

Physics

- Motion and forces (non-contact forces – gravity)
- Forces as pushes or pulls (using force arrows in diagrams)
- Physical changes of matter (wax)
- Conservation of material and of mass, and reversibility, in melting
- Similarities and differences, including density differences, between solids, liquids and gases (wax)

Teacher notes

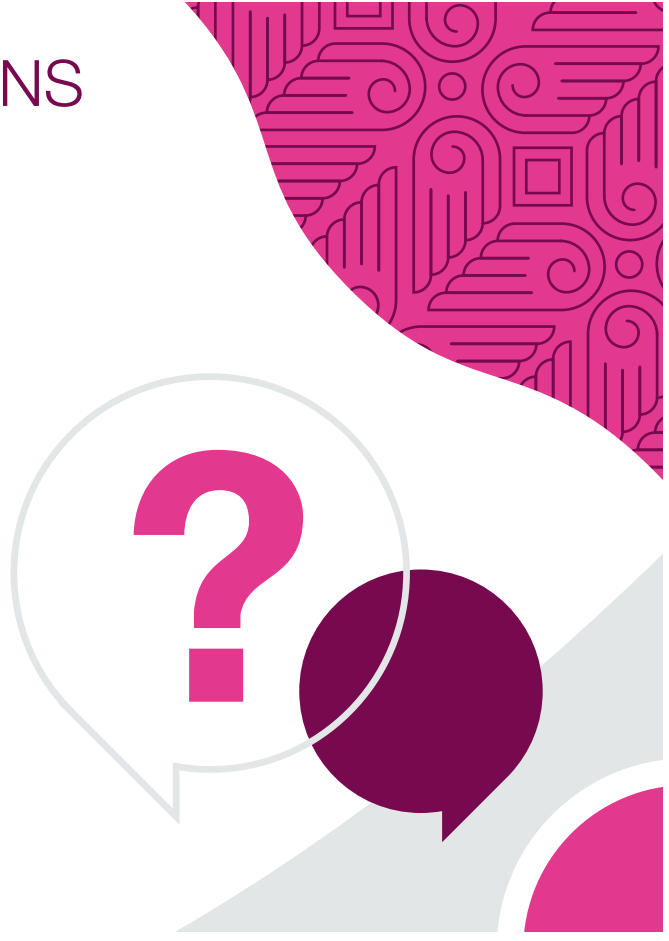
Through this myth, pupils explore the connections between different subject areas and the role of biology, chemistry, and physics in understanding the principles and forces of flight. After Icarus and Daedalus, the first human flight took place on 17th December 1903, when brothers Wilbur and Orville Wright made the first manned, powered flight. It took place at Kitty Hawk, North Carolina, USA. Inspired by kite designs, the plane was made out of wood, fabric, and wire, and it had a slight curve in the wings (like a bird's wing). It was powered by a simple petrol engine driving a propeller. The first flight flew for 37 meters for about 12 seconds at a height of 10 feet. There were three more flights that day and the brothers each took turns to fly the plane.

ICARUS THE BIG QUESTIONS

- Do humans always have to take risks to achieve scientific or technological breakthroughs?
- Are birds' wings the same as human arms?
- Why have some species of birds lost the ability to fly?
- Can mammals and fish fly?

Talking points

- Why did Icarus fly so high?
- Why did Icarus fall?
- Was Daedalus right to trust Icarus to follow his instructions?
- Was the design of the wings a good or bad one?
- How could Daedalus have made the wings safer to use?



ICARUS THE ACTIVITIES

- Read the story
- Create a poster on A4 paper that gives detailed instructions for someone to make their own wings (think about how they will fit and work with the human body)
- Design a health and safety risk assessment checklist for the first flight (Daedalus and Icarus and/or the Wright brothers)
- Make a paper aeroplane and have a group competition to see which flies furthest (discuss the four forces of flight, look at wing shape)
- Draw a diagram of Icarus flying – using force arrows
- Draw a diagram of Icarus falling – using force arrows
- Retell and/or act out the Icarus story using different materials for the wings and different outcomes (with a happy ending, or surprise twist, perhaps)
- Interviews: in small groups, pupils choose one of the following characters – TV Interviewer, Daedalus, Icarus, Orville Wright, Wilbur Wright – and roleplay a TV interview among themselves. Suggested interview questions:
  - What do the Wright Brothers and Daedalus and Icarus have in common?
  - Where did their scientific inspiration come from?
  - Which of them used technology more responsibly?
  - How dangerous was each flight?
  - Be creative, and think of your own questions

PROMETHEUS THE STORY

Long, long ago, when the earth was young, the land was inhabited only by gods and monsters. To fill the empty world, the gods began to create different kinds of animals to live on the earth, swim in its waters, and fly in its sky. They gave the giant Prometheus (whose name means ‘Forethought’) and his brother Epimetheus (whose name means ‘Afterthought’) the important job of ensuring that every animal had what it needed to survive – fur to keep warm in cold temperatures, sharp claws and teeth to catch food, hooves to run, and wings to fly. But foolish Epimetheus didn’t plan ahead when he was handing out all of these gifts to the various creatures and by the time he got to mankind he’d completely run out of useful things to give. Prometheus felt sorry for mankind’s naked, pathetic, state. Humans didn’t have fur, sharp claws or teeth, hooves or wings. They would never survive in the wild!

So Prometheus raided the workshop belonging to Hephaestus, the god of science and metalwork. He stole the secret of fire and gave it to mankind. With fire, mankind could keep warm, cook food, scare predators away, and start to melt and forge metals into tools. The first scientific revolution had begun.

The ruler of the gods, Zeus, was furious at this. So he planned a strange punishment.

He ordered Hephaestus to create the first woman – a kind of clay robot, called Pandora. He ordered the other gods to make her beautiful and charming, and then he sent her into the home of Epimetheus with a box full of all the evils of the world – war, death, hunger, work, illness and suffering. When Epimetheus opened the box, all the evils flew out. He snapped the lid shut as quickly as he could. But it was too late. The only thing left in the box was hope.

Adapted from Hesiod*, Works and Days*
(c. 700 BCE = 2,700 years ago)

PROMETHEUS
THE SCIENCE

KS3 curriculum links

Biology

- Differences between species
- Changes in the environment which may lead to extinction
- Natural selection and adaptation

Chemistry

- The properties of the different states of matter
- The properties of materials
- Elements
- Combustion

Physics

- Energy in matter
- Changes with temperature in motion and spacing of particles
- Internal energy stored in materials (why some materials burn)
- Energy changes and transfers
- Heating and thermal equilibrium

Teacher notes

Through this myth, pupils explore the connections between different subject areas and the role of biology, chemistry, and physics in understanding the properties of heat and fire and, through that, energy. They discuss how fire can be used to initiate reactions and energy supplied can be used to change matter, including compounds and thermal decomposition. Simple heat experiments can help to demonstrate that fire and heat can change the state of some substances, and that new substances can be formed. Energy and fire offer a way of making useless ‘natural’ substances like iron oxide into useful substances like iron. Chemical reactions can release heat energy. The heat energy can turn into light energy, which we know as incandescence and this is what we see as fire. For example, using heat energy, we can start chemical reactions. Chemical reactions produce new substances called products, which have different properties. Copper carbonate decomposes in heat to make copper oxide, for example. This myth also prompts pupils to think about how the use of fire distinguishes humans from other animals, and how animals (including homo sapiens) have adapted to survive in different natural environments.

PROMETHEUS
THE BIG QUESTIONS

- What is fire made of?
- Are humans the only animals who use fire?
- What are some of the things we use fire to do?
- Could humans survive without fire?

Talking Points

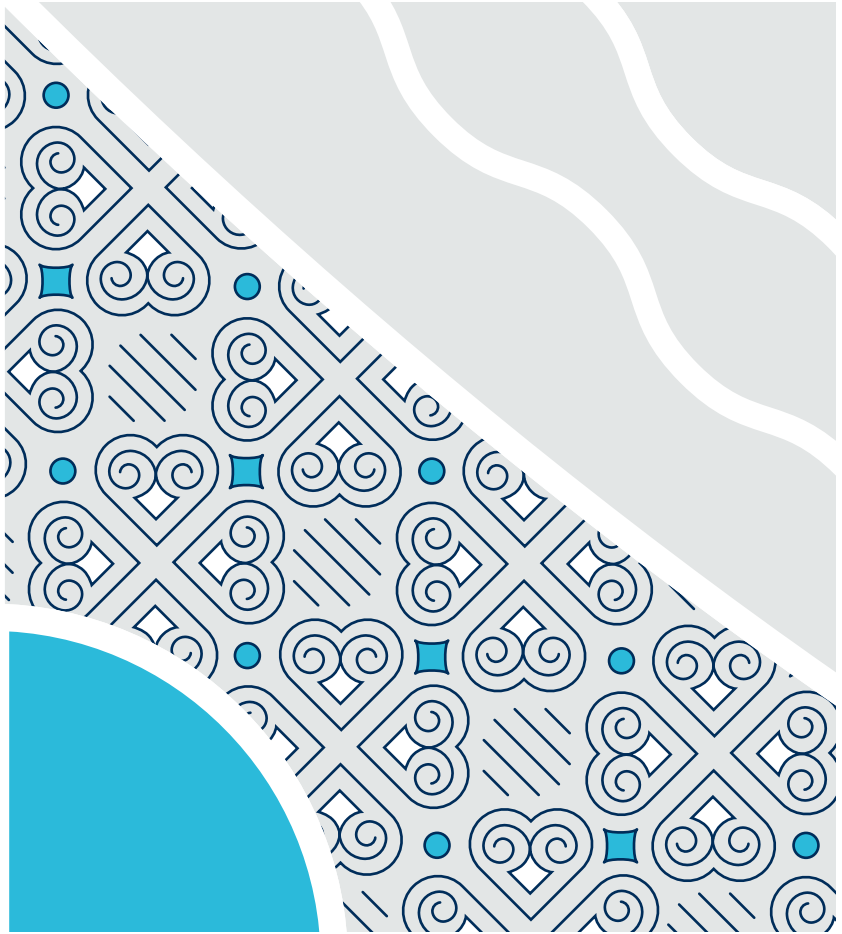
- What other gifts do you wish Epimetheus and Prometheus had given to humans?
- What is hope? Why is it important?
- In science, is it better to be a Prometheus or an Epimetheus?
- Zeus didn't want to share the knowledge of fire: do you think scientists should share their knowledge or keep it secret?
- Who should decide what scientific discoveries are shared and which kept secret?
- Is all scientific knowledge good for human society?

PROMETHEUS THE ACTIVITIES

- Read the story
- Create a poster on A4 paper that gives detailed instructions for someone to make fire (no matches or lighters allowed)
- Design a health and safety risk assessment checklist for making or stealing fire
- List as many materials as you can that burn (do they have any other properties in common?)
- Design your own animal (think about what your creature needs to survive and thrive in its environment)
- Retell and/or act out the Prometheus story with a different outcome (with an unexpected twist, perhaps)
- Retell and/or act out the Epimetheus part of story with a different outcome (with a comedy twist, perhaps)
- Class debate: do you think scientists should share their knowledge or keep it secret? Pupils end the debate by standing on opposite sides of the room based on their viewpoint; they should then be questioned on their position and asked to justify it

PYGMALION
THE STORY

On the island of Cyprus, there once lived an artist named Pygmalion, whose name was famous across the ancient world for his skill in making statues so life-like that people often mistook them for real men and women. One of his projects was to carve a woman out of snow-white ivory. But when it was finished, the statue was so beautiful and so life-like that Pygmalion instantly fell in love with his own creation. It had the face and features of a real woman and was so perfect that it looked like she was about to come alive at any moment.



Pygmalion was amazed at his own work. Again and again, he ran his hands over the statue, trying to tell whether he was touching ivory or skin. He kissed it and thought the statue kissed him back. He talked to it, and held it in his arms. He whispered words of love and brought it little gifts – shells and pretty pebbles at first, then flowers and jewels and clothes. He put rings on the fingers, he put a long necklace round its neck, he put earrings in its ears, and dressed it up in silk gowns. He undressed it too and arranged the statue on his bed, putting a soft pillow beneath its head as if it could feel.

What was he doing?!

In desperation, he prayed to Aphrodite, goddess of love, begging her to give him a real woman 'just like' his statue.

Aphrodite understood what he really meant.

He leaned over the bed and kissed his statue. She felt warm! He pressed his lips against hers again. He felt for her heartbeat. He touched her skin with his hand. It was soft! Overjoyed, but uncertain, he touched her again. He felt a pulse throbbing under his thumb. She was alive!

The girl felt the kisses he gave. She blushed.
And she opened her eyes...

Adapted from Ovid, *Metamorphoses 10*
(c. 1st century CE = 2,000 years ago)

PYGMALION
THE SCIENCE

KS3 curriculum links

Working Scientifically

- Experimental skills and investigations
- Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
- Pay attention to objectivity and concern for accuracy, precision, repeatability

Teacher notes

This myth prompts discussion of what it means to be human and helps pupils develop opinions around the ethics of Artificial Intelligence. They discuss the importance of physical and non-physical conceptions of humanity. The pupils then decide on criteria that will help define what it means to be human and what it means to be alive.

PYGMALION
THE BIG QUESTIONS

- What makes a human a human?
- What makes us alive?
- How do you know you are alive?
- If your brain was put in a machine and it was able to process your thoughts, would that machine be human?
- If someone you loved were killed, but technology created a copy of them which was perfect down to atomic level, would they be the same person?

Talking Points

- Why does Pygmalion keep on testing to see if the statue has come alive?
- What is the evidence that finally convinces Pygmalion his statue is alive?
- Why is it important for scientists to repeat the same experiments?
- Machines respond to inputs, while humans decide what they do? Or do they?
- Can we describe Pygmalion's living statue as a robot? Or an automaton? Or a cyborg?

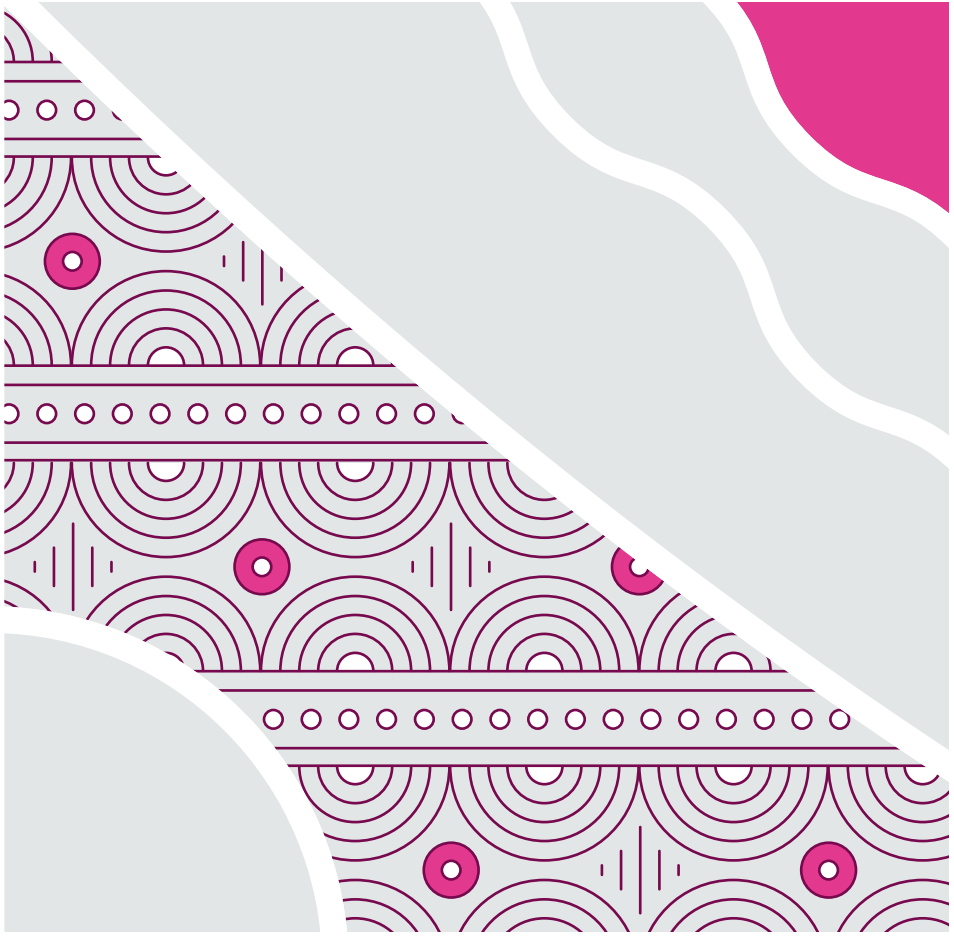
PYGMALION THE ACTIVITIES

- Read the story
- Create a poster on A4 paper that gives detailed instructions for someone to design their own human: think about what it will look like; will it have sex/gender; what colour(s) will it be; what materials will it be made of; will it have any special features or abilities?
- Retell and/or act out the Pygmalion story with a different outcome (with a tragic or unexpected ending, perhaps – remember Frankenstein)
- Make your own fool-proof ‘Human Test’ (or ‘Turing Test’) to see if your partner is a real human or an artificial being: what 10 questions or tests could you use to prove this with scientific certainty? Tests can range from checking if they are breathing, have a pulse, to seeing if they laugh at a joke or a sad story. How does this prove they are human? Can you be 100% sure?
- Class debate: The development of AI is a positive human endeavour that should be explored OR a dangerous and negative endeavour that should be stopped. Pupils end the debate by standing on opposite sides of the room based on their viewpoint; they should then be questioned on their position and asked to justify it

TALOS
THE STORY

As Jason and his Argonauts were heading home from their famous expedition with the witch Medea and the Golden Fleece safely on board their ship, they decided to rest overnight in a safe harbour on the island of Crete. They were tired and thirsty after days spent out at sea and they looked forward to a peaceful night's rest.

But the harbour wasn't safe.



As they tried to tie the ship up, a giant robot made of bronze began to break off great big rocks from the cliffs above them. He threw the mighty boulders down at them in a hail of missiles. The bronze giant, whose name was Talos, had been made by Daedalus to protect the island from enemies and strangers. He was made entirely of armour-plated bronze, and had super-human strength. He could move so fast on his bronze feet as he patrolled the island perimeter that some people thought he might even be able to fly.

The robot's body and limbs were made of strong metal, but below the tendon in his ankle there was a vein of blood, and the thin membrane covering it was his one weak point. His 'Achilles heel'.

The Argonauts were already exhausted but Medea, mistress of magic, came to the rescue. She prepared her equipment and set to work. With her magic she knew there was a way to take control of the robot from a safe distance. She could use her powers to make Talos do exactly what she wanted instead of what he was programmed to do.

She worked her magic.

As Talos was heaving up another great rock to throw down at the Argonauts some strange blood-like fluid flowed out from his ankle like molten lead. Like a mighty pine tree, swaying in the wind, Talos swayed from side to side on his metal feet. Then he fell to the ground with a thunderous crash. Medea had defeated the giant killer robot!

Adapted from Apollonius, *Argonautica 4*
(c. 3rd century BCE
= 2,300 years ago)

TALOS
THE SCIENCE

KS3 curriculum links

Biology

- The structure and functions of the human skeleton
- Biomechanics – reflexes (which appear in the biology specification at GCSE)

Chemistry

- The properties of materials - properties of ceramics, polymers and composites
- The properties of metals and non-metals

Teacher notes

Through this myth, pupils explore the connections between different subject areas and the role of biology and chemistry in understanding biomechanics.

Pupil to Pupil Test – Teacher note: Retina are sensitive to light that enters through the pupil. In low light conditions, the pupil is open as wide as possible to allow as much light into the retina as it can. If the light levels increase, then more light will hit the retina. Optic nerve cells can become over stimulated and damaged if exposed to too much light. In order to prevent that, the pupil closes to limit the amount of light entering the eye. When you close your eye, your eye adjusts to low light conditions, when you open it, the pupils respond to the increased light level.

Knee Jerk Test – Teacher note: It's a monosynaptic reflex arc. The moment you strike the tendon in your knee a signal travels to the spinal cord. There are only two neurons involved (nerve cells) - a sensory neuron and a motor neuron. Other pathways have got more synapses, which can delay the response to a stimulus. You have no 'control' over your body, as monosynaptic signals go nowhere near the brain.

Think Fast – Teacher note: Blinking is one form of the corneal reflex or blink reflex. The blink reflex protects the eye from harm in response to outside stimulation. Blinking or moving when an object moves quickly towards you is part of the 'Menace Reflex'. This involves not only blinking, but also turning of the head or neck away from the harmful object. There are several nerves involved in this pathway, so unlike the Knee jerk it is not monosynaptic.

TALOS THE BIG QUESTIONS

- What makes a robot a robot (rather than a human)?
- Is the development of killer robots for use in war a positive scientific innovation?
- Should robots have human rights?
- If mankind were able to make a fully conscious form of artificial intelligence, would turning it off be murder?
- Should all robots be programmed to protect and not to harm humans?

Talking Points

- Medea the witch takes control of Talos and makes him crash (literally). Does this make her an early ‘hacker’?
- What is the difference between magic and science?
- Is bronze the best material to use when building a giant robot? What materials would be better?
- What is an alloy and why are alloys good to work with?
- Do you feel sorry for Talos at the end of the story?
- Can we describe Talos as a robot? Or an automaton? Or a cyborg?

TALOS THE ACTIVITIES

- Read the story
- Design your own robot: it has to be bigger than life size, powerful enough to throw heavy stone boulders at enemies, light enough to move at speed, be weather resistant, and difficult to destroy: think about what materials it will be made of – an alloy such as brass, solder, bronze, steel?
- List the pros and cons of making a robot out of: brass, solder, bronze, steel, silver, gold, clay, wood, plastic, tin, copper
- Retell and/or act out the Talos story with a different outcome (with a happy or comedy ending, perhaps)
- Conduct a series of experiments to see to what extent humans are automata (robots): are human beings simple machines designed to react to stimuli in certain ways to protect ourselves (suggestions below)?
- Class debate: The development of AI robots is a positive human endeavour that should be explored OR a dangerous and negative endeavour that should be stopped. Pupils end the debate by standing on opposite sides of the room based on their viewpoint; they should then be questioned on their position and asked to justify it

Test 1: Pupil to Pupil

Turn to your partner and ask them to close their eyes for 10 seconds. Ask them to quickly open their eyes whilst you look closely at their pupils.

What do you notice? This is called the pupillary response. So, how does this protect the body?

Test 2: Knee Jerk

Have a partner sit on a table with their legs crossed so that their knee can swing freely. Hit their leg just below the knee with the side of your hand. (DO NOT USE A HAMMER!)

What do you notice? This is called a monosynaptic reflex arc. So, how might this protect the body?

Test 3: Think Fast

Have your partner hold a transparent Poly Pocket in front of their face. Clap your hands in front of your partner's face.

What do you notice? Did they blink? Why? So, how might this protect the body?

TYPHON THE STORY

A long, long, time ago, the mythical world was ruled by the god Zeus. But Zeus ruled by fear. He held on to his power by defeating and punishing anyone who dared to challenge his authority. So when an ambitious monster named Typhon began hurling rocks at him, Zeus met his challenger head-on. He quickly defeated Typhon but was then faced with a new problem. Typhon was immortal, so he couldn't be killed. But he couldn't be allowed to go free, or he might rise up again to threaten Zeus. What should Zeus do with Typhon?

Zeus decided to build a prison. Or rather, he decided to ask Hephaestus, the god of science and metalworking, to design and build him a prison. A prison so strong and so secure that it could jail a god. Forever.

Zeus went to Hephaestus' workshop, which was located at the base of a mighty volcano. Hephaestus worked with metal, and to melt metal he needed extreme heat. The volcano was perfect for this. Hephaestus made use of the hot magma in his divine laboratory and workshop, channelling the heat to melt metal, to create super-strong alloys, and to forge incredible objects.

Hephaestus made lots of suggestions for Typhon's prison. Before long, Zeus' attention began to wander. He was bored. He started to look around the workshop... The workshop had no roof and was open to the sky. The floor was made of thick black volcanic rock. And instead of walls, each side of the room was a waterfall of molten rock, like a curtain of hot lava constantly pouring down towards the centre of the earth.

Zeus had an idea. The workshop itself would make the perfect prison cell for Typhon.

Hephaestus wasn't too happy with the idea. He would lose his workshop. But he knew better than to argue with Zeus.

So the king of the gods threw Typhon into this strange jail, using his power to seal all exits and entrances with rock and lava by pushing two of the great tectonic plates of the earth against each other. Typhon was trapped inside a volcano. Jailed forever inside what people now call Mt Etna.

Adapted from Hesiod, *Theogony*
(c. 700 BCE = 2,700 years ago)

TYPHON
THE SCIENCE

KS3 curriculum links

Chemistry

- Earth and atmosphere
- The composition of the Earth
- The structure of the Earth
- The rock cycle and the formation of igneous rocks
- The properties of the different states of matter
- The properties of materials
- Elements
- Combustion

Physics

- Energy in matter
- Changes with temperature in motion and spacing of particles

Teacher notes

Through this myth, pupils explore the connections between different subject areas and the role of chemistry and physics in understanding earth science. The ground that we walk on is the outermost layer of the earth. It comes into direct contact with the air and water, and so it is cold and hard. Underneath the earth's crust, however, is another layer, called the mantle. The mantle is made of rock that is so hot that it's molten – this is called magma. If the magma was to come into contact with the air and water, it would cool and harden and become a part of the crust.

TYPHON
THE BIG QUESTIONS

- Why do some people choose to live near active volcanoes?
- Is it right or wrong to challenge and question scientific experts?
- Could the heat from an active volcano be used to heat our homes and schools?
- Scientists predict that a volcano is about to erupt and kill thousands of people living near it, but there's no time to evacuate the area or save anyone: should they keep quiet or tell people?

Talking Points

- What sort of properties would a prison need to have to hold such a powerful monster as Typhon?
- What materials would you use to build such a prison?
- What would you do with Typhon?
- The ancient Greeks believed that the volcanic eruptions from Mt Etna were caused by Typhon trying to escape his prison. What are the real reasons that volcanoes erupt?
- Are there any links between earthquakes and volcanic eruptions?

TYPHON THE ACTIVITIES

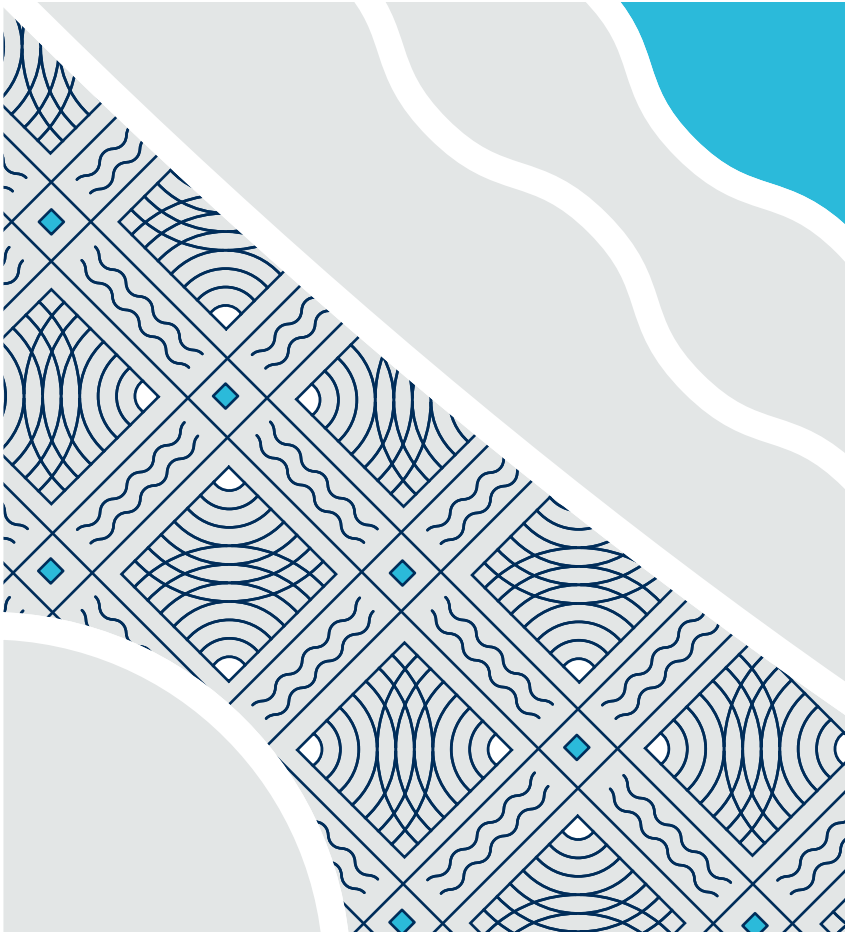
- Read the story
- Design your own prison to hold Typhon: it has to be big enough to hold a giant and last forever, impossible to escape from: think about what materials will it be made of
- Draw and label an erupting volcano
- Retell and/or act out the Typhon story with a different outcome (with an escape, or by switching the roles of hero and villain, perhaps)
- Produce a risk assessment listing 10 pros and cons of living beside an active volcano. Ideas might include: ignorance of the danger; eruptions make for very fertile soil that's good for farming; eruptions don't happen often so it's a measured risk; lack of money or ability to move away; heritage and connection to the area means people don't want to move away; geothermal energy can be harnessed to heat water and even produce electricity so it can be cheap and clean to live in these regions; volcanoes are a tourist attraction so living nearby will bring tourist money into the region; the lava contains minerals that can be mined once cooled
- Class debate: Human settlements near a volcano are sensible and should be encouraged OR dangerous and should be stopped. Pupils end the debate by standing on opposite sides of the room based on their viewpoint; they should then be questioned on their position and asked to justify it

ECHO THE STORY

Once upon a time, a girl called Echo was famous for her ability to chat. She could just talk and talk and talk until the cows came home! That is, until Echo's constant talking and chattering irritated the goddess Juno so much that she decided to shut Echo up for good.

Juno took away Echo's voice, allowing her only to repeat the words of others.

Sad and lonely, unable to hold proper conversations with her friends, Echo took herself away into the woods and lived alone in a cave. She talked to nobody and nobody talked to her. Until one day, when a beautiful young man named Narcissus got lost in the woods. He was so beautiful that Echo couldn't help herself from falling in love with him at first sight. She had to find a way to tell him, to talk to him.



Lost and tired, Narcissus sat down beside a pool, resting his weary feet in its waters. He did not see Echo watching him silently. If only she could talk!

Echo screwed up her courage, and tapped the man on the shoulder.

‘Hello,’ said Narcissus, ‘What’s your name?’

‘Name,’ said Echo.

‘Well alright Name. Hello. Why did you just touch me?’ said Narcissus.

‘Touch me,’ echoed Echo.

‘What?’ said Narcissus.

‘What?’ said Echo.

Echo realized that the conversation was not going well. Embarrassed, she ran back to her cave, hiding herself away in the dark.

Narcissus didn’t really know what to make of any of this so he followed her.

Standing in the mouth of the cave, he called out ‘Hello!’ And after a delay of 2 seconds he heard her reply: ‘Hello!’

He walked a little way into the cave and tried again: ‘Name, are you in here?’ An echo came back after 1 second: ‘In here!’

He moved further and deeper into the cave, calling for ‘Name’, until there was no reply, no more echo, just the sound of his own voice.

He gave up and headed back into the woods, still calling out for ‘Name’.

Echo realized now that she would never be able to have a proper conversation again. Her heart broken, she prayed to Juno to relieve her of her pain. And Juno answered her prayer. Sort of. She allowed Echo to die, her body to fade away, leaving only her voice behind.

To this day, Echo still haunts places like caves, and forests, canyons and wells. If you shout loudly enough, you might hear her.

Adapted from Ovid,
Metamorphoses 3
(c.1st century CE
= 2,000 years ago)

ECHO
THE SCIENCE

KS3 curriculum links

Physics

- Frequencies of sound waves, measured in hertz (Hz); echoes, reflection and absorption of sound
- Sound needs a medium to travel, the speed of sound in air, in water, in solids
- Sound produced by vibrations of objects, in loudspeakers, detected by their effects on microphone diaphragm and the ear drum; sound waves are longitudinal
- The auditory range of humans and animals

Teacher notes

Through this myth, pupils explore the physics of sound waves. All sounds are caused by vibrations in the air that our auditory system is able to interpret as sounds. Allow pupils to see this in action by putting a finger to their voice box and feeling how it vibrates slightly when they hum.

Sound travels through the air as a wave. When it hits a solid hard surface, some of this wave is absorbed, and the rest is reflected back. When the surface is soft or uneven, the wave gets reflected in lots of directions all at once and is diffused, so it doesn't echo as clearly. However, if the surface is hard and flat, more of the wave will be reflected back in the direction it came from.

Sound takes time to travel: 330 metres per second. Sound needs a medium to travel and travels at different rates through different materials. The speed of 330 m/s is a rough figure for how quickly sound moves through dry air. The presence of moisture or other gases can speed up or slow down the movement of sound, depending on density. The closer the molecules are to one another, the more quickly the sound is able to travel.

ECHO THE BIG QUESTIONS

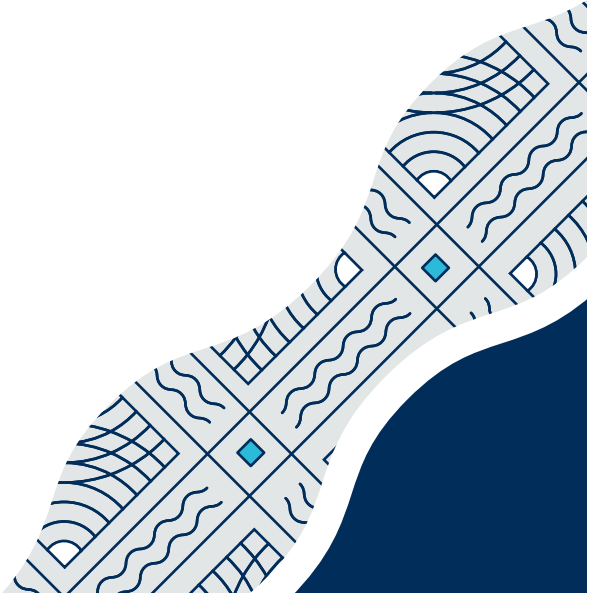
- You and your best friend win a trip to the moon: does the sound of your voice echo in space?
- What is an echo made of?
- Are echoes useful?
- Are echoes dangerous? (hearing our own opinions ‘echoed’ back to us can be limiting; discuss the idea of social media as an ‘echo chamber’)

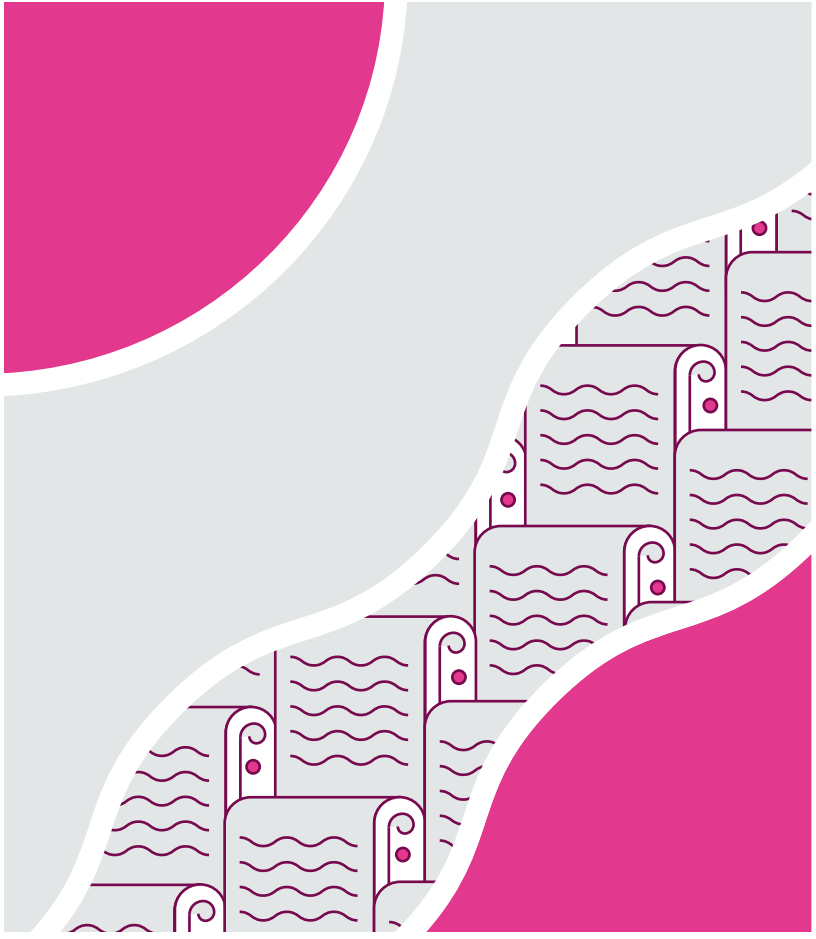
Talking Points

- A lightening flash and thunder are produced simultaneously, but thunder is heard a few seconds after the flash is seen: why?
- Can we hear echoes in a room furnished with curtains and carpets? Why (not)?
- Why was there a delay between Narcissus calling out to Echo and her ‘reply’?
- If we assume that sound travels at a distance of 330 metres per second, how deep was Echo’s cave? (660 metres). Explain how we know
- How far had Narcissus travelled between his first and second shouts? (330 metres). Explain how we know

ECHO THE ACTIVITIES

- Read the story
- Split into pairs. Choose one person to play Echo. They cannot speak unless they are repeating words someone else has already spoken. Try to have a conversation in this way
- Write your own conversation between Narcissus and Echo – and then act it out
- Draw and label a diagram of Echo's cave with Narcissus at the entrance: draw the soundwaves of his first shout and her first reply
- Design a poster advertising Echo's echoes. What could we use knowledge about echoes to do? Possibilities include: record sound effects; make music; calculate distance and depth; sonograms; sonar for detecting rocks or submarines underwater (also used by bats, fish, some mammals – such as dolphins and whales, and insects)
- Choose one pupil in the group to be a bat/dolphin and the rest to be insects/fish. Blindfold the bat/dolphin and the others disperse around the room. Have the bat/dolphin squeak loudly. After every squeak, the insects/fish squeak back. The bat/dolphin will use the 'echo' of its squeaks to find and eat the insects/fish





SOCRATES
THE STORY

The ancient philosopher Plato was taking his usual stroll around town after dinner when he ran into his old friend Ion. Ion was a famous actor and storyteller of the time. Thousands of years before science and technology would make the internet, TV, and cinema popular forms of entertainment, Ion would travel to lands near and far, telling stories and acting out scenes from famous myths to entertain huge crowds. He was feeling pretty pleased with himself today as he'd just won an award for one of his stories. But Socrates wasn't really impressed.

‘It’s great to be a storyteller,’ said Ion. ‘It’s the best job in the world. When I’m telling one of my stories people are hanging on my every word.’

Socrates wasn’t really impressed. ‘Like iron filings hanging from a magnet,’ he muttered.

Ion didn’t seem to hear him. ‘When I tell a sad story, I look down on the audience from up on the stage and I can see them all in tears. It’s great! And when I’m telling them a scary story, I see them looking terrified. Storytelling is a powerful thing. You should give it a try yourself sometime.’

But Socrates wasn’t impressed.

‘Are your stories always about real people and real events, then? Is that what makes your audience react with these strong emotions?’

‘O no,’ said Ion. ‘I tell myths mostly. You know the sort of thing. Gods and monsters, sexy cyborgs, killer robots. Audiences go mad for killer robots.’

Socrates still wasn’t impressed. So Ion tried to explain.

‘It’s not the content of the story that produces these affects on the audience. It’s all down to the way I tell it,’ said Ion. ‘I can tell the same story lots of different ways. I can make heroes into villains, or make villains into heroes. And, of course, I make lots of money along the way.’ He laughed.

But Socrates still wasn’t impressed. He said goodnight to Ion and continued on his walk, thinking. About ethics mostly. And wondering whether, in an ideal world, there should be a ban on storytellers like Ion.

Adapted from Plato, *Ion*
(c. 4th century CE
= 2,400 years ago)

SOCRATES
THE SCIENCE

KS3 curriculum links

Working Scientifically

- Communicating scientific knowledge and understanding
- Paying attention to objectivity

Teacher notes

This story invites pupils to think about the ways in which stories about science are communicated in various media. They are encouraged to question the subjective and emotional representation of science in popular news stories. Scientists must strive for objectivity but stories about scientists are often narrated in ways that are far from sharing that objectivity.

This story and topic is ideally supported with a selection of contemporary news stories featuring science in the popular press and social media.

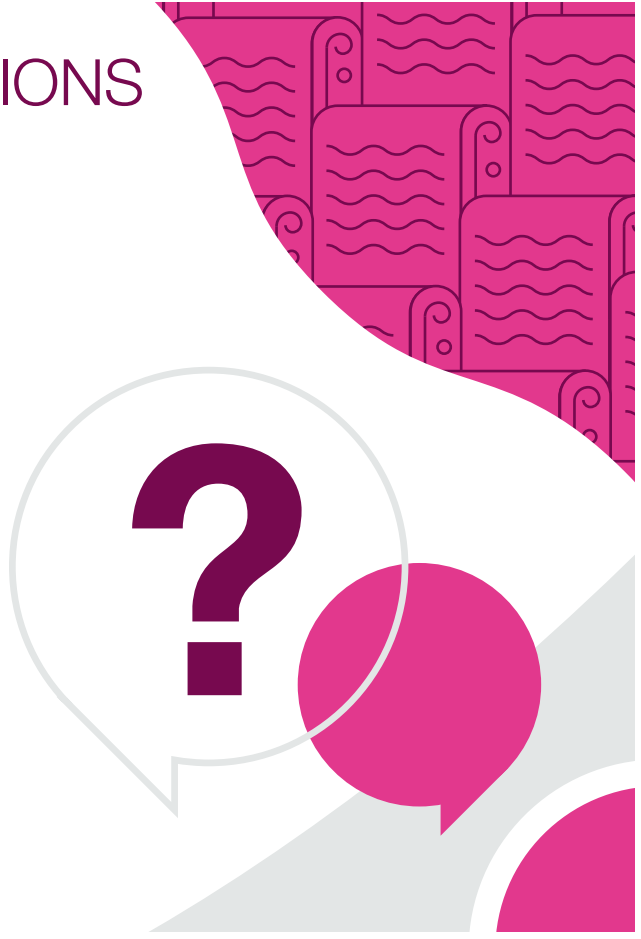
Connecting emotionally with science and its stories can help to engage the interest of pupils who prefer arts and humanities subjects to science. Try using tragic stories (the Chernobyl disaster, wildlife affected by pollution, climate change, etc.) and science stories involving children and young adults to provoke interest and pose questions of risk, responsibility, and ethics.

SOCRATES THE BIG QUESTIONS

- What does it mean to be objective? Give some examples.
- What does it mean to be subjective? Give some examples.
- ‘There’s no place for emotion in science’. Do you agree?
- What are ethics?
- A news report links eating salt and vinegar crisps to better GCSE exam performance. The report is based on one scientific research paper and a trial using a sample of 8 pupils. Do you start eating more crisps?
- ‘Facebook causes cancer’. This is an actual news headline from the Daily Mail. Do you tell your friends to delete their Facebook accounts?

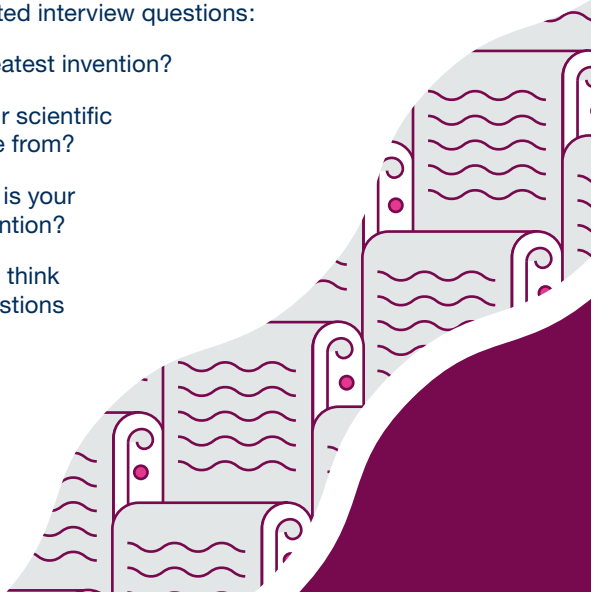
Talking Points

- Why is it so important for scientists to publish their results?
- Are newspapers, TV shows, and other public forums the best way for scientists to publish and communicate their findings?
- Why do scientists bother to subject the results of their experiments to anonymous peer review? Why not put them straight up on the internet?
- If you had the power, would you ban ‘storytellers’ like Ion from publishing bad science and sensationalist science stories?
- Is all scientific knowledge good for human society?



SOCRATES THE ACTIVITIES

- Read the story
- On a side of A4 write a short news story based on any one of the stories in this book OR a science story that is currently in the news: make it a good news story where the scientist/innovator is a hero (remember to give your story a good headline)
- Swap your story with a partner and now rewrite their story as a bad news story where the scientist/innovator is a villain (remember to give your story a great headline)
- Design a 'Wanted Poster' for Bad Science: list all the wrongs and harms to society to which you think bad science has contributed
- Interviews: in a group, pupils choose one of the following characters – TV Interviewer, Prometheus, Epimetheus, Hephaestus, Pygmalion, Medea – and roleplay a TV interview among themselves. The Interviewer decides whether they want to make each character come across as a 'hero' or a 'villain'. Suggested interview questions:
  - What is your greatest invention?
  - Where does your scientific inspiration come from?
  - How dangerous is your research or invention?
  - Be creative, and think of your own questions



SCIENCE CAPITAL

One of our aims in developing these resources is to help teachers use classical stories and ancient myths to enhance ‘science capital’ in their KS3 pupils. The concept of ‘science capital’ is derived from Bourdieu’s notion of ‘cultural capital’ and helps to explain why some people engage with STEM subjects more readily than others **(www.transformingpractice.sciencemuseum.org.uk/2016/06/01/what-is-science-capital)**. Recent research conducted by the Science Museum reveals that there are a number of factors which can affect a pupil’s connection to and relationship with science. This research further suggests that by offering arts and humanities pathways to science, and by engaging pupils in extra-curricular science-oriented activities, teachers can better engage these pupils and encourage their relationships with science to grow.

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An interactive pdf that can be used as a digital version of this book, plus additional web-based materials, can be found on our website:
www.bristol.ac.uk/classics/hub

For more information and additional resources, and to give us your feedback, visit our website:
www.bristol.ac.uk/classics/hub

These materials and teachers' notes introduce, consolidate, and extend core knowledge and understanding linked to the KS3 National Curriculum for Science.

They are designed for use in science lessons, science and STEM clubs – and they are also ideally suited for use by gifted and talented groups, debate groups, storytelling societies, and classics clubs.

These resources were developed in a collaboration between classics and science teachers in schools across the South West, the national charity Classics for All, the Bristol and South West Classics Hub, and the University of Bristol.

bristol.ac.uk/classics/hub