The Science Curriculum at Brownlow Fold

The Learning Challenge

The Learning Challenge concept is built around the principle of greater **learner involvement** in their work. It requires deep thinking and encourages learners to work using a question as the starting point. In designing the curriculum, teachers and learners are using a **prime learning challenge**, expressed as a question, as the starting point. Using the information gained from pre learning tasks and our school context, a series of **subsidiary challenges** are then planned. Each subsidiary learning challenge is also expressed as a question. Importantly, the learning challenges need to make sense to the learners and be something that is within their immediate understanding.

Within each Learning Challenge unit of work, we always include a 'Green for Growth Challenge. ' These challenges are designed to enable pupils to work at greater depth within a particular unit. Some of the characteristics of a child who is working at greater depth might include:

- Working independently
- Applying what they have learned in one area of a subject to other areas
- Applying their knowledge consistently, confidently and fluently
- Being able to explain what they have been doing to others, including teaching other children what they have learned.

Pre-learning tasks to ensure that our pupils are directly involved in the planning process. Well planned pre-learning tasks to help bring out what our pupils already know; what misconceptions they may have and what really interests them. Our teachers then take account of the outcomes from pre-learning tasks to plan the subsidiary learning challenges for each major area of study.

Empowered Learners

By adopting the 'Empowering Learning' skills, we recognise the impact that personal skills can have on the academic success and well-being of our children. They play a vital role in developing the ability of learners to enjoy and reflect on their learning across the curriculum. The six areas for personal development; Self-Management, Effective Partnership, Resourceful Thinkers, Reflective Learners, Independent Enquirers and Team Workers; form what we class as personal skills which are worked upon throughout a child's time at Brownlow Fold Primary School.

Self-Manager

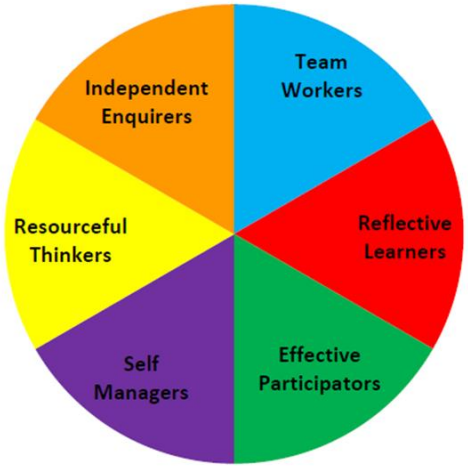
- Ability to organise themselves and work out goals and priorities
- Show personal responsibility, initiative, creativity and enterprise
- Anticipate, take and manage risks
- Commit themselves to learning and self-improvement
- Respond positively to change

Effective Participators

- Engage actively with issues that affect them and those around them.
- Play a full part in the life of the school
- Take responsible action to bring improvement for others as well as themselves
- Discuss issues of concern, seeking resolution
- Present a persuasive case for action
- Propose practical ways forward
- Try to influence others, negotiating and balancing diverse views

Resourceful Thinker

- Think creatively by generating and exploring relevant ideas, and making original connections



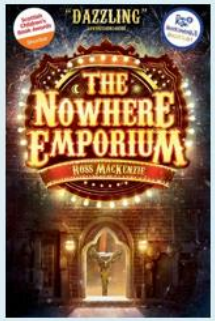
	▪ Find links and see relationships
	▪ Explore and experiment with resources and materials
	▪ Ask ‘why’, ‘how’ and ‘what if’ questions
	▪ Apply imaginative thinking to solve a problem
	▪ Try different ways to tackle a problem
	▪ Work with others to find imaginative solutions and outcomes that are of value
Reflective Learner	▪ Evaluate their strengths and limitations as learners
	▪ Review their work and act on outcomes
	▪ Set themselves realistic goals and criteria for success
	▪ Monitor their own performance and progress
	▪ Invite feedback and deal positively with praise, setbacks and criticism.
	▪ Make changes to improve their learning
	▪ Communicate their learning in relevant ways to different audiences
Independent Enquirer	▪ Gather, process and evaluate information in their investigations
	▪ Plan what to do and how to go about it
	▪ Draw conclusions and evaluate outcomes
	▪ Take informed and well-reasoned decisions, recognising that other have different beliefs and attitudes
	▪ Use range of techniques to collect and organise information
Team Worker	▪ Work confidently with others, adapting to different contexts and taking responsibility for their own role
	▪ Listen and take account of others’ views
	▪ Form collaborative relationships, resolving issues and reaching agreed outcomes

- Adapt behaviours to suit different roles and situations
- Show fairness and consideration towards others

Year Five

Space

Will Liam really be the next astronaut to land on the moon?



Life cycles

How different will you be when you are as old as your grandparents?

Forces

Does everything that goes up always come down?

Green for Growth Challenge

Can you draw on all the knowledge you have acquired to design a machine that includes levers, pulleys, cams or gears?

Prime Learning Challenge

Earth and Space and Forces

Does everything that goes up always come down?

Big Question

Can you describe the movement of the Earth and other planets relative to the sun in the solar system?	Can you describe movement of the moon relative to the Earth?	Can you describe the shape of the sun, Earth and moon?	Can you explain day and night and the apparent movement of the sun across the sky?
Can you explain that unsupported objects fall towards the Earth due to gravity?	Can you identify the effects of air resistance and water resistance?	Can you identify the effects of friction?	Can you explain how levers, pulleys, cams and gears make our lives easier?

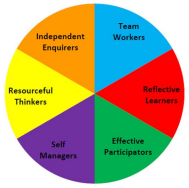
Small Questions

Which help to answer the big question.

Key Vocabulary

Planets	Spherical	Orbit	Air resistance	Friction
Solar system	Rotate	Gravity	Water resistance	Mechanism

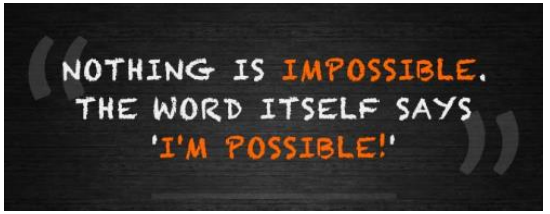
Empowered Learner Links

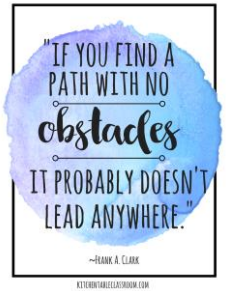


Self Manager

- I recognise risks that may be involved when tackling my work.
- I can organise things well, including resources and others, when working independently.
- I appreciate how learning can happen from mistakes.
- I can use success criteria to check on how successful a task has been.
- I am happy to persevere even when the solution is not easily at hand.

Growth Mindset Links

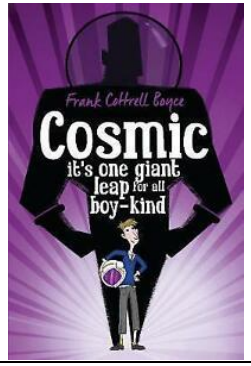




Cross-Curricular Writing Opportunities

- Explanation text of how night and day is created.

Text



Glossary

Planets
A celestial body moving in an elliptical orbit round a star.

Spherical
Shaped like a sphere.

Orbit
The curved path of a celestial object or spacecraft round a star, planet, or moon, especially a periodic elliptical revolution.

Resistance
The impeding or stopping effect exerted by one material thing on another.

Friction
The resistance that one surface or object encounters when moving over another.

Solar system
The collection of eight planets and their moons in orbit round the sun, together with smaller bodies in the form of asteroids, meteoroids, and comets.

Rotate
Move or cause to move in a circle round an axis or centre.

Gravity
The force that attracts a body towards the centre of the earth, or towards any other physical body having mass.

Levers
A rigid bar resting on a pivot, used to move a heavy or firmly fixed load with one end when pressure is applied to the other.

Gears
A toothed wheel that works with others to alter the relation between the speed of a driving mechanism (such as the engine of a vehicle) and the speed of the driven parts (the wheels).

Pulleys
A wheel with a grooved rim around which a cord passes, which acts to change the direction of a force applied to the cord and is used to raise heavy weights.

Force
An influence tending to change the motion of a body or produce motion or stress in a stationary body.

Practical Science

Equipment

- Material to make parachutes
- Modelling clay
- Measuring cylinders
- Stopwatches
- Mechanno
- Images of planets, sun and Moon
- Spherical shapes in a range of sizes

Forces – Year 5

Key vocabulary	
force	A force is a push or a pull. Forces make objects start moving, stop moving, speed up, slow down or change direction.
gravity	A force which pulls things down towards the centre of the Earth.
forcemeter	Piece of equipment used to measure the size of a force.
Newton (N)	The unit for measuring force.
air resistance	The force that slows down objects that move through air.
water resistance	A force that slows down objects moving through water.
friction	When one surface moves against another, the rubbing force that tries to top them is called friction. It gives us grip.
mechanisms	A device that allows a small force to be increased to a larger force.
simple machines	Levers, pulleys and gears are all types of simple machines.

Real-life examples of forces in action

A skydiver falls fast until they open their parachute.

Dolphins have a streamlined shape.

A non-slip mat uses friction.

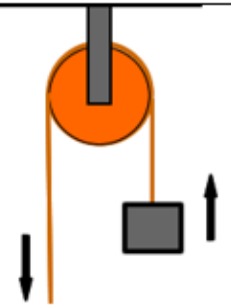
Significant scientists	
Traditional	
Galileo Galilei *(1564-1642)* 	He was an Italian scientist. He discovered that if two objects of similar shape and size are dropped, they will fall at the same rate.
Sir Isaac Newton *(1642-1726)* 	He was an English scientist and mathematician. He 'discovered' the concept of gravity when sitting under a tree and an apple fell to the ground near him.
Contemporary	
Emma England - Aeronautical engineer Emma works as part of a team designing the wings of aircrafts.	

Seeds fall to the ground because of gravity.

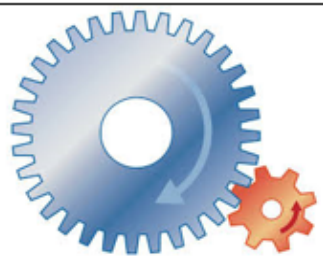
Simple machines

These are used to make tasks easier. This means you need to use less force.

A **lever** tilts on a pivot which is nearer to the end of the pivot with a heavy load.



Pulleys have a rope or cable which goes over a wheel. This is pulled to lift, lower or move heavy objects.



Gears are toothed wheels which lock together and turn each other to form simple machines.

Earth and space – Year 5

Key vocabulary	
Earth	The planet we live on. It is the third planet from the Sun.
Sun	The Sun is the star at the centre of our solar system. **It is not safe to look directly at the Sun, even when wearing dark glasses.**
Moon	The moon is the only natural satellite of the Earth.
planets	Large round objects, made of rock or gas, that move around the sun.
solar system	The sun and all the planets that orbit around it.
star	A huge ball of glowing gas in space.
rotate	When an object rotates it turns (spins) on its axis.
orbit	The curved path that an object follows going around a star or a planet.

The Sun is a star at the centre of our solar system.

There are 8 planets in our solar system: **Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune.**

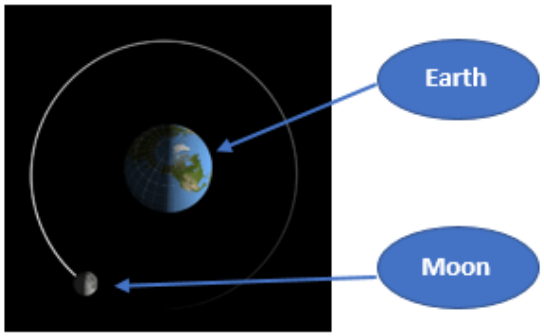
These all **orbit** (travel) around the sun.

Significant scientists	
Nicolaus Copernicus *(1473-1543)* 	Nicolaus was a Polish astronomer and mathematician who formulated the heliocentric model of the solar system that placed the Sun rather than the Earth at the centre of the universe.
Maggie Aderin-Pocock *(born 1968)* 	Maggie is a British space scientist and science educator. She is working on the observation instruments for the Aeolus satellite, which will measure wind speeds to help the investigation of climate change.

The Sun, Earth and Moon are approximately spherical bodies.

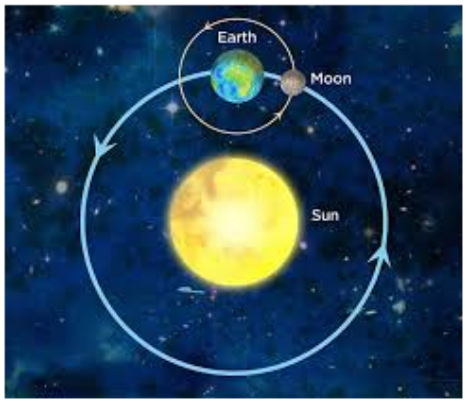
The moon orbits the Earth

It takes about 28 days to complete its orbit.

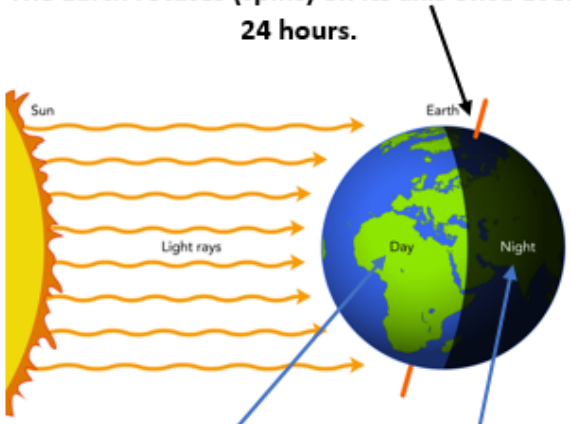


The Earth orbits the Sun.

It takes 365¼ days to complete its orbit around the Sun. This is a year.



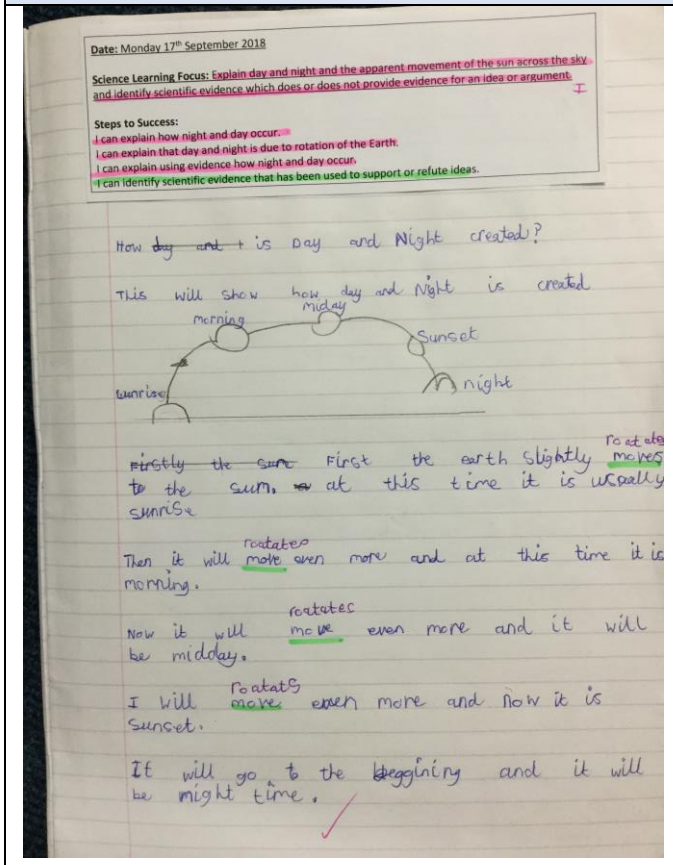
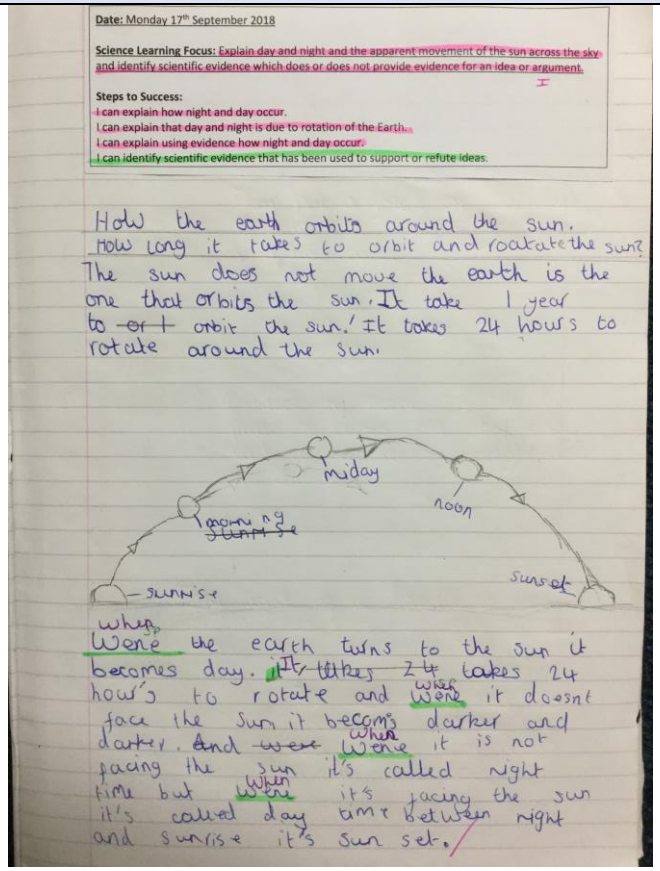
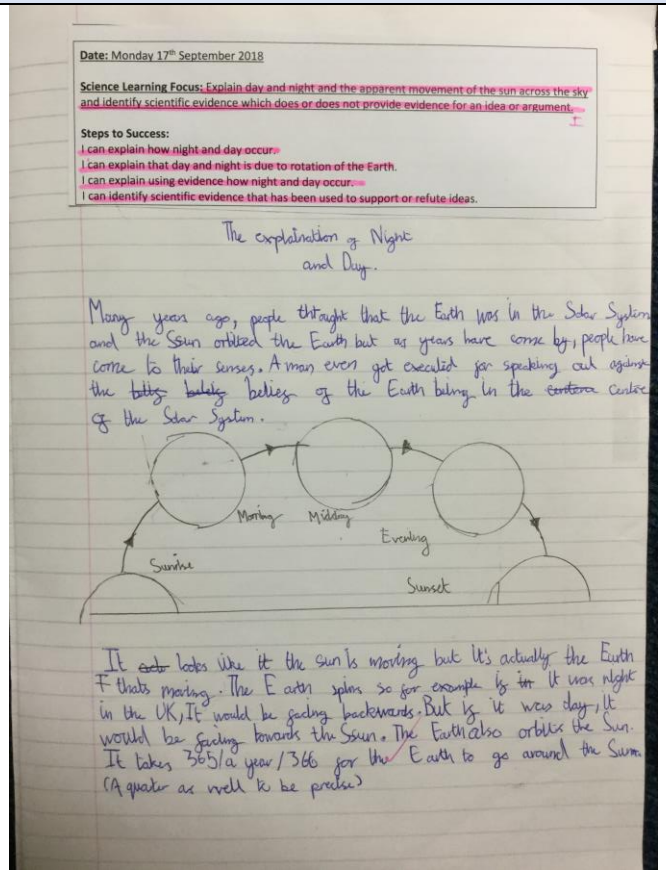
The Earth rotates (spins) on its axis once every 24 hours.



It is day for the half of the Earth facing the Sun.

It is night for the half of the Earth facing away from the Sun.

Assessment Criterion

Emerging	Expected	Exceeding
		

Enrichment opportunities

- Hands on experiments
- Making a parachute and testing it

Home Learning/Parental Links

- Look at the night sky and see what constellations you can identify

Green for Growth Challenge

Can you draw on all the knowledge and skills you have acquired to plan and carry out a fair test investigation to separate different sized solids from a mixture?

Prime Learning Challenge
Materials and their properties
Can you explain what the world, and everything around you, is made from?

Big Question

Can you compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets?	Can you explain that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution?	Can you use your knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating?	Can you give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic?
Can you demonstrate that dissolving, mixing and changes of state are reversible changes?	Can you explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible?		

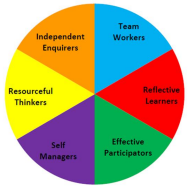
Small Questions

Which help to answer the big question.

Key Vocabulary

Materials	Hardness	Transparency	Dissolving	Reversible
Properties	Solubility	Conductivity	Filtering	Irreversible

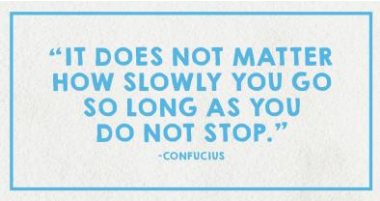
Empowered Learner Links



Independent Enquirer

- I recognise that sometimes you need expertise from others to help solve a problem.
- I can show that I am confident enough to plan clear steps to take to improve my learning.
- I can plan a longer activity, breaking it into a manageable number of steps.
- I can make constructive judgement about someone else's work.
- I can set targets for completing learning and work to them.

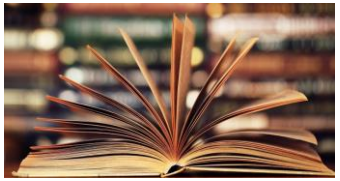
Growth Mindset Links

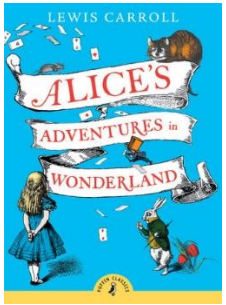


Cross-Curricular Writing Opportunities

Write a diary entry from the point of view of Alice.

Text





Glossary

Transparency

The condition of being transparent (see-through).

Dissolving

When a solid becomes or has cause to become incorporated into a liquid so as to form a solution.

Reversible

Capable of being reversed so that the previous state or situation is restored.

Solubility

The ability to be dissolved, especially in water.

Conductivity

The degree to which a specified material conducts electricity, calculated as the ratio of the current density in the material to the electric field which causes the flow of current.

State

A physical condition as regards internal or molecular form or structure.

Solid

Firm and stable in shape; not liquid or fluid.

Liquid

A substance that flows freely but is of constant volume, having a consistency like that of water or oil.

Gas

A substance or matter in a state in which it will expand freely to fill the whole of a container, having no fixed shape (unlike a solid) and no fixed volume (unlike a liquid).

Filtering

Pass (a liquid, gas, light, or sound) through a device to remove unwanted material.

Evaporating

Turn from liquid into vapour.

Practical Science

Equipment

- Different materials
- Magnets
- Bulbs, wires, batteries, clips etc.
- Pan and heat
- Filter paper
- Beakers
- Balloons

Properties and changes of materials – Year 5

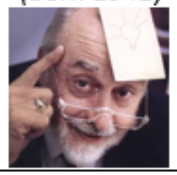
Key vocabulary	
thermal insulator	Does not allow heat to pass through it easily.
thermal conductor	Allows heat to pass through it easily.
electrical insulator	Does not allow electricity to pass through it.
electrical conductor	Allows electricity to pass through it.
dissolve	A solid that completely mixes in with a liquid and cannot be seen.
solution	A mixture of a liquid with a dissolved solid or gas.
soluble	Solids and gases that dissolve in liquids.
insoluble	Solids that do not dissolve in a liquid.
sieve	Separates solids of different sizes.
filter	Separates an insoluble solid that is mixed in a liquid.
evaporation	Separates a soluble solid and a liquid.
reversible change	Changes that can be switched back and are not permanent. E.g. dissolving, melting, freezing
non-reversible change	Changes that can not be reversed back to their original state. E.g. burning, rusting

Materials can be grouped together based on their properties. For example:

- hardness
- solubility
- transparency
- thermal conductivity
- electrical conductivity
- response to magnets

Significant scientists

Spencer Silver *(born 1941)*

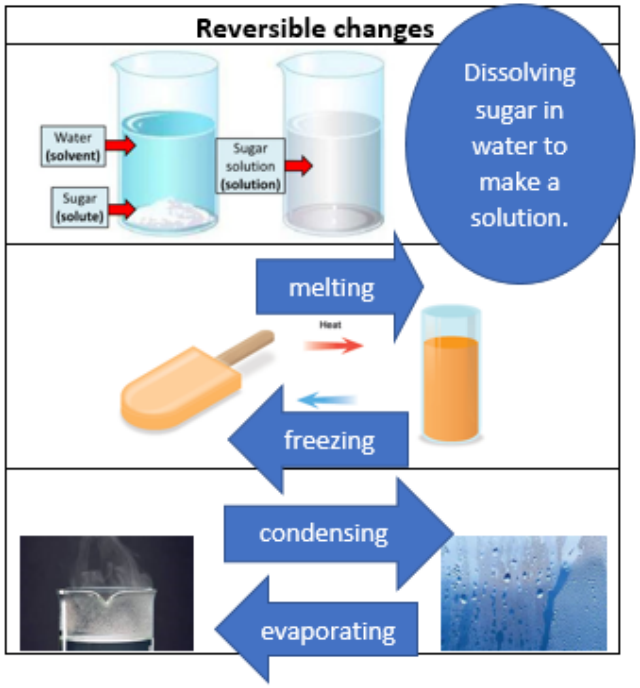


Spencer Silver is an American scientist who together with Arthur Fry was the inventor of Post-it notes in 1974. At the time, he was working to develop new classes of adhesives.

Joe Keddie

Joe Keddie is a professor of Soft Matter Physics at the University of Surrey. He is interested in the fundamental processes of soft matter, especially polymer thin films and nanoparticles.

Reversible changes



Separating materials

Sieving separates the stones and twigs from the soil.

Filtering separates the sand from the mixture.

Evaporating separates the dissolved salt from the water.

Non-reversible changes - these result in the formation of new materials

Burning

Mixing vinegar and bicarbonate of soda

Rusting

Assessment Criterion		
Emerging	Expected	Exceeding

Enrichment opportunities

- Hands on experiments using a range of different equipment
- National Science Week

Home Learning/Parental Links

- Follow a recipe to cook a meal and discuss what changes of state are reversible and irreversible

Green for Growth Challenge

Can you jointly plan and prepare an unscripted group presentation about the life cycle of an animal you have studied?

Prime Learning Challenge

How do animals and plants change over time and produce new animals and plants?

Can you explain how you will be different when you are as old as your grandparents?

Big Question

Small Questions

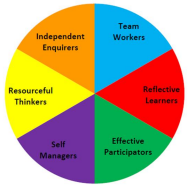
Which help to answer the big question.

Can you describe the differences in the life cycle of a bird, an amphibian, a mammal and an insect?	Can you produce a diagram showing the life cycle of a butterfly and a frog?	Can you explain the life cycle of a flower?	Can you identify the different parts of a flower?
Can you describe the life processes of reproduction in some plants?	Can you explain how flowers spread their seeds?	Can you describe the changes as humans develop to old age?	Can you describe the life processes of reproduction in some animals?

Key Vocabulary

Life cycle	Amphibian	Insect	Stigma	Sepal
Bird	Mammal	Reproduction	Stamen	Pollen

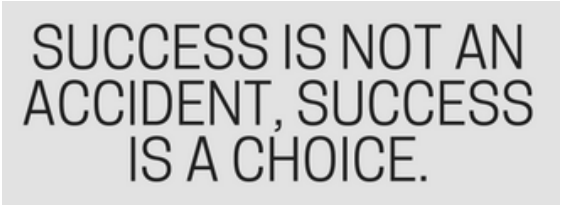
Empowered Learner Links

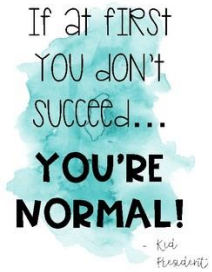


Team Worker

- I am able to take on a range of roles within a group.
- I can accept constructive criticism from others in a group to enable improvement in my performance.
- I can share a working environment with others and respect their varying needs.
- I can motivate others to contribute more effectively.
- I understand differences in opinions and respond positively.

Growth Mindset Links

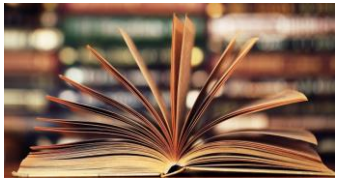


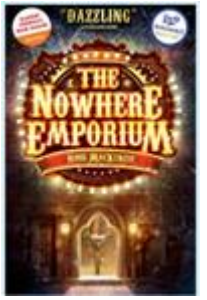


Cross-Curricular Writing Opportunities

- Write a persuasive letter to encourage someone to be more environmentally friendly, looking at the impact that it is having on the Rainforest.

Text





Glossary

Life cycle
The series of changes in the life of an organism including reproduction.

Amphibian
A cold-blooded vertebrate animal of a class that comprises the frogs, toads, newts, salamanders, and caecilians. They are distinguished by having an aquatic gill-breathing larval stage followed (typically) by a terrestrial lung-breathing adult stage.

Insect
A small arthropod animal that has six legs and generally one or two pairs of wings.

Stigma
In a flower, the part of a pistil that receives the pollen during pollination.

Sepal
Each of the parts of the calyx of a flower, enclosing the petals and typically green and leaflike.

Bird
A warm-blooded egg-laying vertebrate animal distinguished by the possession of feathers, wings, a beak, and typically by being able to fly.

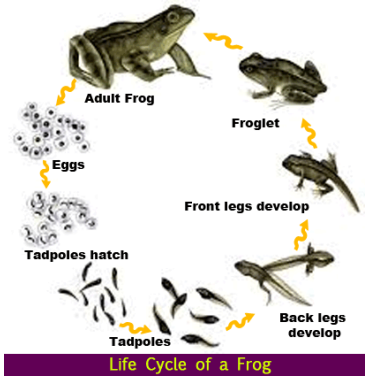
Mammal
A warm-blooded vertebrate animal of a class that is distinguished by the possession of hair or fur, females that secrete milk for the nourishment of the young, and (typically) the birth of live young.

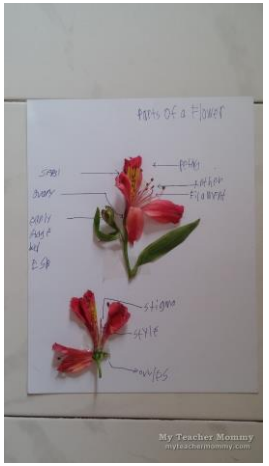
Reproduction
The production of offspring by a sexual or asexual process.

Stamen
The male fertilizing organ of a flower, typically consisting of a pollen-containing anther and a filament.

Pollen
A fine powdery substance, typically yellow, consisting of microscopic grains discharged from the male part of a flower or from a male cone. Each grain contains a male gamete that can fertilize the female ovule, to which pollen is transported by the wind, insects, or other animals.

Practical Science





Equipment

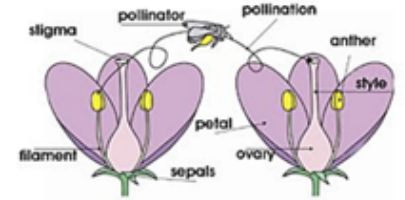
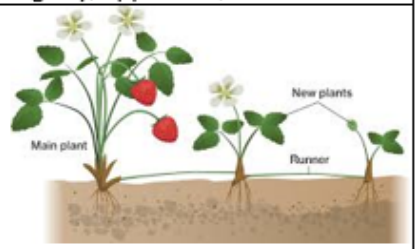
- Images of mammals
- Images of birds
- Images of insects
- Images of amphibians
- Different flowers
- Life cycle examples

Living things and their habitats – Year 5

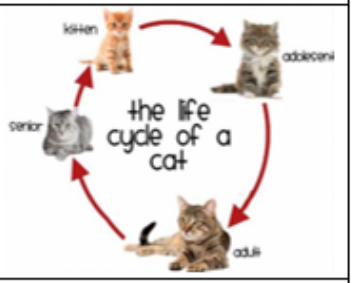
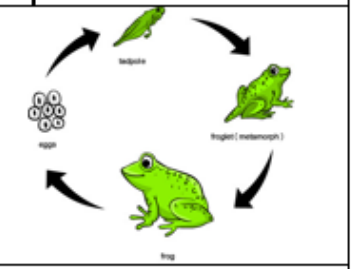
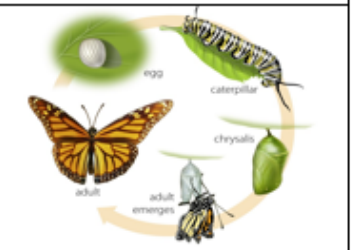
Key vocabulary	
life cycle	This shows, how things are born, how they grow and how they reproduce.
reproduction	As part of their life cycle plants and animals reproduce. There is sexual and asexual reproduction.
sexual reproduction	Both the male and female are needed. Most animals reproduce sexually.
asexual reproduction	Only one parent is needed. This occurs mostly in plants and bacteria.
fertilise	In animals: When the male sperm reaches the female egg. In plants: When the male pollen reaches the female ovule.
metamorphosis	A major change from one form to another in the life cycle of some animals when they change from young to an adult.
runner	A long stem of a plant that grows along the ground in order to put down roots in a new place.
bulb	A round root of some plants from which the plant grows.
cutting	A piece, such as a roof, stem or leaf cut from a plant and used to grow another plant of the same type.
tuber	a swollen underground stem or root of a plant from which new plants can grow.

Significant scientists	
David Attenborough *(born 1926)* 	Sir David is an English broadcaster and naturalist. He has made many famous wildlife programmes. He was knighted in 1985.
Lucy Evelyn Cheesman *(1881-1969)* 	Lucy Cheesman was a British entomologist (someone who studies insects) and traveller. She collected over 70,000 specimens of insects, plants and other animals.

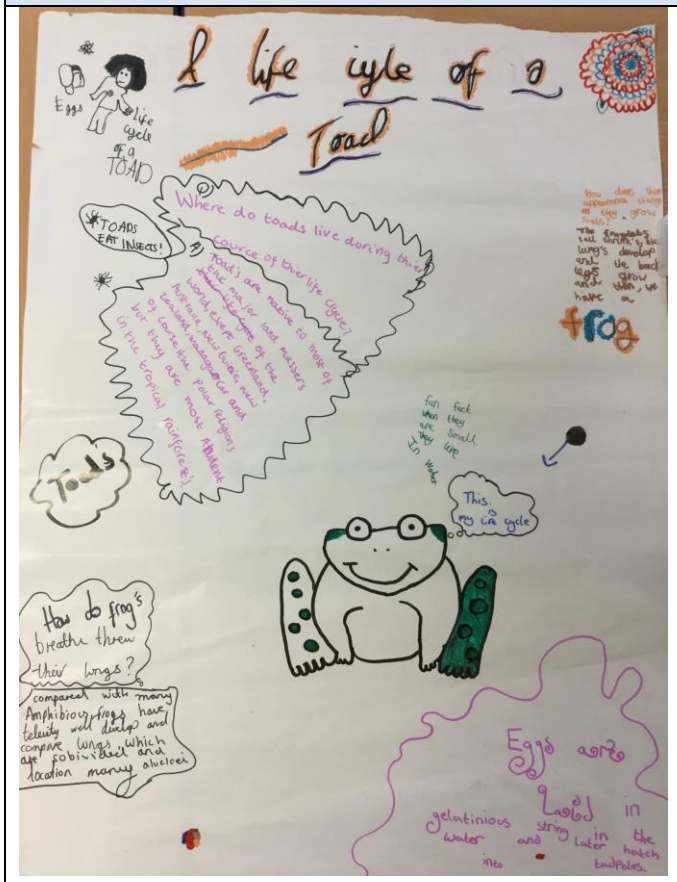
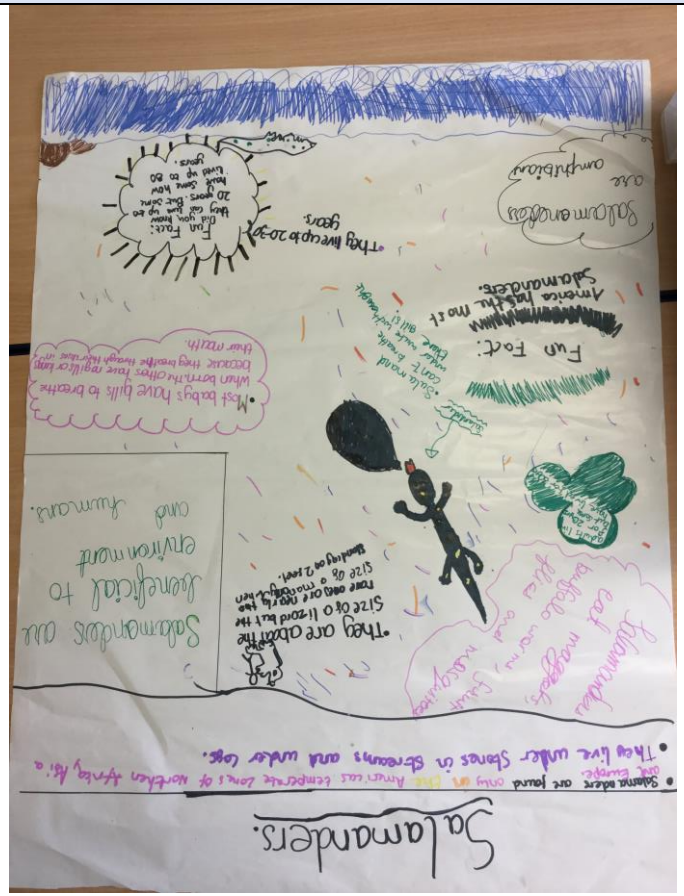
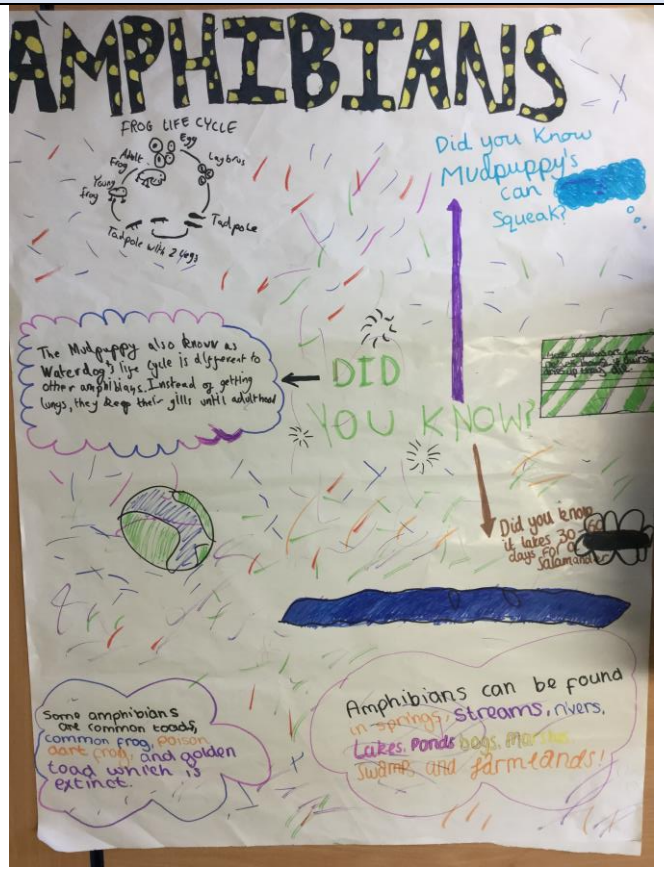
Plants reproduce both sexually and asexually

Sexual reproduction occurs through pollination usually involving wind or insects.	 E.g. lily, apple tree, tomato
Asexual reproduction involves only one parent using bulbs, tubers, runners and cuttings.	 E.g. spider plant, potato, strawberry

Life cycles of animals

Mammal	
- female gives birth to young - Live young are born - young looks like adult - female provides milk for young	
Amphibian	
- eggs laid in water - young go through different form before looking like adult - no parental care	
Insect	
- egg laid and then hatch - some grow to adult but most go through metamorphosis to adult	
Bird	
- eggs laid in a nest - young hatches from an egg - grow to adult - parental care after hatching	

Assessment Criterion

Emerging	Expected	Exceeding
		

Enrichment opportunities

- Trip to Blackpool Zoo – workshop linked to life cycles of animals

Home Learning/Parental Links

- Go for a walk and pick some wild flowers then dissect the flower to identify the different parts

Photographic evidence