Year 6 Science Curriculum

The National Curriculum for science intends that children's understanding of the nature, processes and methods of science is developed through different types of science enquiries that help them to answer scientific questions about the world around them. Within each year group, substantive (knowledge) content should be taught through practical opportunities that enable children to develop a range of 'Working Scientifically' skills. These skills, from the National Curriculum, are provided below and are then exemplified in relation to each science unit.

Year 5/6 Working Scientifically Skills			
Plan	**Do**	**Record**	**Review**
• Plan different types* of scientific enquiries to answer their own questions, including recognising and controlling variables where necessary. • Use test results to make predictions to set up further comparative and fair tests. • **Types of enquiry including: observing changes over time, noticing patterns, grouping and classifying, comparative and fair tests, using secondary sources.* • ***Pupils in years 5 and 6 should use their science experiences to:*** • *Explore ideas and raise different kinds of questions;* • *Select and plan the most appropriate type of scientific enquiry to use to answer scientific questions;*	• Use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate • *They should use and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environment.* • *They should make their own decisions about what observations to make, what measurements to use and how long to make them for, and whether to repeat them; choose the most appropriate equipment to make measurements and explain how to use it accurately.*	• Record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar, and line graphs. • Report and present findings from enquiries, including conclusions and causal relationships, in oral and written forms such as displays and other presentations, using appropriate scientific language. • *They should decide how to record data from a choice of familiar approaches;*	• Explain degree of trust in results. • Identify and evaluate scientific evidence (their own and others') that has been used to support or refute ideas or arguments. • Describe and evaluate their own and others' scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources. • Draw conclusions, explain, and evaluate their methods and findings, communicating these in a variety of ways. • Raise further questions that could be investigated, based on their data and observations. • *They should look for different causal relationships in their data and identify evidence that refutes or supports their ideas.* • *They should use their results to identify when further tests and observations might be needed; recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact.*

• *Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why.*			• *They should use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas and should talk about how scientific ideas have developed over time.*

Statutory content is specified below and is supported by reference to non-statutory guidance. Non-statutory guidance is shown in *italics*
The six main types of enquiries are highlighted within each unit to ensure appropriate coverage across each year group:

Observing over time	Pattern Seeking	Identifying, Classifying and Grouping	Comparative and Fair testing	Researching using secondary sources	Exploring

Unit and Vocabulary:	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Electricity **Prior vocabulary:** electricity; appliances; devices; mains; plug; (electrical) circuit; complete circuit; circuit diagram; components; cell; battery; positive/negative; connect/connection/loose connection; short circuit; wire, crocodile clip; bulb, bulb holder; bright(er)/dim(mer); switch; buzzer, motor, (propeller) faster/slower; (electrical) conductor/insulator; metal/non-metal **New vocabulary:** **circuit symbol; terminal; volume; voltage, current, resistance, series circuit (parallel circuit)** **Use causal relationships** (-er statements) to link the effect of changing components eg The greater the number of volts, the brighter the bulb	**Pupils should be taught to:** • associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit. • compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches. • use recognised symbols when representing a simple circuit in a diagram. • *Building on their work in year 4, pupils should construct simple series circuits, to help them to answer questions about what happens when they try different components, for example, switches, bulbs, buzzers and motors.* • *They should learn how to represent a simple circuit in a diagram using recognised symbols.* • *Note: Pupils are expected to learn only about series circuits, not parallel circuits. Pupils should be taught to take the necessary precautions for working safely with electricity.*	**Pupils should be taught to:** • plan different types* of scientific enquiries to answer their own questions, including recognising and controlling variables where necessary. • use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate. • record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs. • report and present findings from enquiries, including conclusions and causal relationships, in oral and written forms such as displays and other presentations, using appropriate scientific language. • explain degree of trust in results. • draw conclusions, explain, and evaluate their methods and findings, communicating these in a variety of ways. • use test results to make predictions to set up further comparative and fair tests.

Implementation-activity examples and cultural capital opportunities	**Observing over time** • Observe how the brightness of bulbs change over time. Key questions • **How does the brightness of bulb change as the battery runs out?** • **How can we measure how quickly a battery is used up?** **Pattern Seeking** • Investigate which type of battery lasts the longest. • Investigate how the temperature of a bulb changes over time. Key questions • **Do more expensive batteries last longer?** • **Does the temperature of a light bulb go up the longer it is on?** **Identifying and Classifying** • Identify and group electrical components and appliances based on what electricity makes them do. • Identify and group electrical appliances based on the amount of electricity that they use. Key questions • **How would you group electrical components and appliances based on what electricity makes them do?** • **How would you group electrical appliances based on the amount of electricity that they use?** **Comparative and Fair Testing** • Carry out fair tests exploring what effect changing components in a circuit has. Key questions • **How does the voltage of the batteries in a circuit affect the brightness of the lamp?** • **How does the voltage of the batteries in a circuit affect the volume of the buzzer?** • **Which make of battery lasts the longest?** • **Which type of fruit makes the best fruity battery?** • **How does increasing the length of the wires affect the brightness of the bulb or the noise level of the buzzer?** **Researching using secondary sources** • Research how our knowledge and understanding of electricity has changed over time. Key question • **How has our understanding of electricity changed over time?**

	Exploring and Problem Solving • Make a simple torch or burglar alarm. • Explore how a circuit operates to achieve particular operations, such as to control the light from a torch with different brightness's or make a motor go faster or slower. • Make circuits to solve particular problems, such as an alarm to warn about rising waters which might cause a flood. • Explore how much electricity pupils use in a day/week, see Explorify https://explorify.uk/en/activities/the-big-question/how-much-electricity-do-we-use • Explore how much electricity it takes to run a school (see BBC Terrific Scientific, https://www.bbc.co.uk/teach/terrific-scientific/KS2/zmqv92p • Challenge pupils to make 'Scribblebots'. See The Ogden Trust for more information, https://www.ogdentrust.com/resources/phizzi-practicals-scribblebot • Based on their learning, challenge pupils to think of new questions they'd like to investigate about electricity – where possible enable them to do investigations to answer them. Key questions • **How much electricity do we use?** • **Can you design and make a torch/burglar alarm?** • **Can you design and make a flood early warning system?** **Cultural capital opportunities:** **Sustainable Development Goals**: Number 7: affordable energy; Number 13: climate action; Number 11: sustainable cities and communities. **Climate change links:** Research renewable sources of electricity. Research how to reduce the amount of electricity that we use. **Visits/trips**: A local power station, solar or wind farm **Visitors:** An electrician; A representative from an electricity provider or renewable energy company. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Alessandro Volta (Electrical Battery) Nicola Tesla (Alternating Currents), Michael Faraday (generating electricity). ***Make sure pupils are exposed to a diverse range of scientists including scientists who are working today. See,** • **The PSTT** https://pstt.org.uk/resources/curriculum-materials/ASJLM & https://pstt.org.uk/resources/curriculum-materials/Science-at-Work • **The Ogden Trust** https://www.ogdentrust.com/resources/research-cards-women-in-physics • **STEM Sisters** http://www.hmdt.org.uk/hmdtmusic/stemsisters/the-stem-sisters-2/, • **Oxford Sparks** https://www.oxfordsparks.ox.ac.uk/justaddimagination **for resources to support this.** **Enrichment experiences:** • Explore plasma balls work and how they work. • Learn about and make simple electromagnets.

	• Explore the electricity simulations on the Colorado PHET website, https://phet.colorado.edu/en/simulations/filter?subjects=physics&type=html&sort=alpha&view=grid
Subject Links	**English** • Write consumer reports about different types of batteries/electrical appliances. • Write instructions for making a torch/burglar alarm. • Write a short science fiction story based on the premise, 'What if there was a power cut for a week?' • Write a 'how to' guide for reducing the amount of electricity that we use. • Write a biography about a scientist who played a key role in developing our knowledge of electricity. Related texts • Goodnight, Mister Tom (Michelle Magorian) • Blackout (John Rocco) • Hitler's Canary (Sandi Toksvig) **Maths** • Use line graphs to represent how the brightness/temperature of a bulb changes over time. • Calculate how much electricity the pupils use in a day/week. The amount of electricity or power used is measured in kilowatt hours (kWh) which is called one unit of electricity. It is estimated that 1 kWh is roughly the amount of power consumed by: ○ 6 minutes in an electric shower ○ 30 minutes cooking in an oven ○ 10 boils of a kettle ○ 1 washing machine cycle ○ 1 hour of ironing ○ 3 hours of television ○ 48 hours of laptop computer use ○ 5 days of connecting your internet **Computing/Technology** • Use data loggers to measure the brightness of bulbs in Lux (Lx); volume of buzzers in decibels (dB); display data in graphs e.g. using Excel or online graphing packages e.g. create-a-graph. **DT** • Design and make a torch, burglar alarm or set of traffic lights. • Design and make switches for different purposes: ○ a switch that is on until it is turned off – use light bulb ○ a switch that is only on when held on e.g. lawn mower – use motor and propeller ○ a switch that is triggered by pressure – use buzzer

	PSHE • Pupils could learn about safety issues related to electricity including the importance of never playing near pylons or entering electricity substations. They could also learn about the difference between voltage in batteries and from the mains and why they should never play with plug sockets. **Geography** • Research where different types of renewable electricity can best be generated around the world. **History** • Research how our knowledge of electricity has developed over time, see The Ogden Trust, https://www.ogdentrust.com/resources/scientific-ideas-over-time-electricity **Music** • Investigate how speakers and electric guitars work.

Unit and Vocabulary:	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Light **Prior vocabulary:** light, light source, names of light sources e.g. candle, torch etc, dark/ness, reflect, reflective, reflector, mirror; shadow, block, direct/ion, transparent, translucent, opaque **New vocabulary:** absorb; (shadow) formation; angle of incidence/reflection, vocabulary to do with the eye e.g. retina, lens, cornea, pupil, iris, optic nerve	**Pupils should be taught to:** • recognise that light appears to travel in straight lines • use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye • explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes • use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them • *Pupils should build on the work on light in year 3, exploring the way that light behaves, including light sources, reflection and shadows. They should talk about what happens and make predictions.*	**Pupils should be taught to:** • plan different types of scientific enquiries to answer their own questions, including recognising and controlling variables where necessary. • report and present findings from enquiries, including conclusions and causal relationships, in oral and written forms such as displays and other presentations, using appropriate scientific language. • draw conclusions, explain and evaluate their methods and findings, communicating these in a variety of ways. • identify and evaluate scientific evidence (their own and others') that has been used to support or refute ideas or arguments.
Implementation-activity examples and cultural capital opportunities	**Observing over time** • Investigate how light levels change in the classroom over the course of a day. Key question • **How does the amount of light in the classroom change over the course of a day?** **Pattern Seeking** • Investigate patterns in how light levels change in different places over the course of a day. • Identify patterns in how different shadows change over the course of a day. Key questions • **Is there a pattern to how bright it is in school over the day? If there is a pattern, is it the same in every classroom?** • **Do all shadows change in the same way?**	

	Identifying and Classifying
	• Identify light sources and classify them as natural and human made.
	Key question
	• **How many light sources can you identify? Can you sort them into natural or human made?**
	
	Comparative and Fair Testing
	• Investigate how light rays reflect off a mirror.
	• Investigate how reflective different materials are.
	Key questions
	• **How does the angle that a light ray hits a plane mirror affect the angle at which it reflects off the surface?**
	• **Which material is most/least reflective? Which material should we use to make cycling safety clothing out of? Why?**
	
	Researching using secondary sources
	• Research how our knowledge of how we see has changed over time.
	• Research about scientists and thinkers who have advanced our knowledge of light. See The Ogden Trust for resources to support this, https://www.ogdentrust.com/resources/research-cards-light/
	Key questions
	• **How has our knowledge and understanding about how we see changed over time?**
	
	Exploring and Problem Solving
	• Explore different ways to demonstrate that light travels in straight lines e.g.
	  ○ Attach red or blue cellophane to one end of a 1 metre piece of flexible tubing. Shine a torch down it while it is straight and observe how the light appears at the bottom and is filtered through the cellophane. Repeat but this time bend the tubing – no light will come out of the bottom because light cannot bend.
	  ○ Make the room as dark as possible. Sprinkle fine powder into the beam of a powerful torch. This will reveal that it is straight.
	  ○ Shine a torch through different shaped holes in card.
	  ○ Look at a tea light through a straight tube. Cover the end of the tube and try to observe the tea light again – it can't be seen because the light can no longer travel up the tube and can't bend around the side either. Check the CLEAPSS guidance about using tea lights/candles. Alternatively use electronic tea lights/candles.
	• Explore how we see luminous and non-luminous objects and create models to demonstrate this.
	• Explore how a periscope works. Make their own simple periscope.
	• Explore how a sundial works. Make their own simple sundial.
	• See Explorify, https://explorify.uk/en/activities/problem-solvers/build-a-sundial
	• Based on their learning, challenge pupils to think of new questions they'd like to investigate about light – where possible enable them to do investigations to answer them.

	Key questions • **How do we see luminous and non-luminous objects?** • **How does a periscope work?** • **How does a sundial work?** **Cultural capital opportunities:** **Sustainable Development Goals**: Number 14: Life below water (less light as depth of water increases). **Climate change links:** Learn about how the polar ice caps reflect significant amounts of the Sun's light and heat and how the melting of the polar ice caps will increase climate change. **Visits/trips**: A local theatre/TV studio to explore how productions are lit. **Visitors:** Lighting engineer, optician/optometrist. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Ibn Al-Haytham (Alhazen) (Light and our Eyes) Percy Shaw (The Cats Eye) **Enrichment experiences:** • Recreate Isaac Newton's famous experiment and split white light into its constituent parts. ○ Rainbows can be made by placing a piece of card with a thin slit cut out of it in front of a class or water on a sunny shelf. • Find out which is faster – light or sound. Send a child with a drum or pair of cymbals to the far side of the field. Give a signal for them to hit the drum/cymbals while the rest of the class watches. They will see the drums/cymbals be hit a before the hear the sound. *This will only work if you have an open space that is at least 300 metres wide. • Freeze different coloured liquids (e.g., milk, coke, orange juice) and explore which melt the quickest and why. • Explore why the sky is blue. Fill a tank with water. Add some milk. Make the room as dark as possible and shine a torch into one side of the tank. From the other side the torch's light will appear blue in colour. The milk represents the billions of pieces of dust floating in the Earth's atmosphere which 'scatter' the blue part of the Sun's light – making the sky blue. • Pupils could explore triboluminescence. This is a phenomenon in which light is generated when a material is mechanically pulled apart, ripped, scratched, crushed, or rubbed. Glow sticks are an example of triboluminescence. If sugar cubes are crushed in pitch black conditions they will emit blue flashes of light. • Pupils could learn about bioluminescent animals and plants.

Subject Links	

English

- Write a short science fiction story based on the premise, '*what if the Sun disappeared?'*
- Write a diary entry in the character of Ibn Al-Haytham (Alhazen) detailing his discoveries about light.

Related texts

- Letters from the Lighthouse (Emma Carroll)
- The Gruffalo's Child (Julia Donaldson)
- The King Who Banned the Dark (Emily Haworth-Booth)
- The Dark—Lemony Snicket
  - Does The Dark really behave like it does in the story?
- The Game in the Dark—Herve Tullet
  - How are shadows formed? How can we change the shape/size of shadows?
  - Which materials would be best for a book like this that casts shadows?

Maths

- Display the speed of light (metres per second). Challenge the pupils to say/write the number and put it into a PV grid. Ask them the value of different digits.
- Present data about how light levels change over a day in a line graph.
- Estimate and measure the angle that a light beam reflects off a mirror. *Is it acute or obtuse?* Challenge the pupils to get a light beam to reflect off a mirror at exactly a right angle.
- Use light beams to make different 2-Dshapes e.g., squares, right-angle triangles etc.

Computing/Technology

- Use data-loggers to measure how light levels change over the course of a day. Present this data using Excel or 'Create-a-graph'.

DT

- Make periscopes, sundials, kaleidoscopes or colour spinning wheels.

RE

- Learn about how the sun is regarded in different religions.

PHSE/Citizenship

- Learn about the dangers of:
  - Looking directly at the sun.
  - Skin cancer and exposure to sunlight.
  - Cycling, walking in the dark without high visibility clothing.

	Geography • Explore how the number of hours of daylight is different in different parts of the world including the poles. **History** • Learn about the life and work of Ibn Al Haytham, 'the father of optics' and the first scientist to establish the basic principles of light and how we see. See 1001 Inventions for more information, https://www.1001inventions.com/initiatives/ibn-al-haytham/ • Research the history of the development of different light sources (see The Ogden Trust, https://www.ogdentrust.com/resources/scientific-ideas-over-time-timeline-card-sort-game-light-sources • Research how our knowledge of how we see has developed over time. **Art** • Explore colour wheels and mixing different colours to make new ones.

Unit and Vocabulary	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Animals including humans **Prior vocabulary:** survival, needs, wants, food, food groups, dairy, carbohydrates, sugars, protein, fats, vitamins, minerals, dietary fibre, balanced diet, nutrition, nutrients, water, air, breathing, digestive system, names of main body parts, mouth, teeth, canines, incisors, molars, premolars, saliva, tongue, rip, tear, chew, grind, cut, oesophagus (gullet), stomach, small intestine, large intestine, rectum, anus, skeleton, muscles, support, protection, movement, bones, skull, ribs, vertebrate/ invertebrate, spine/vertebrae, joints, sockets, tendons, exercise, healthy, clean, wash, hygiene, medicine, drugs **New vocabulary:** **circulatory system, heart, pumps, oxygen, carbon dioxide, lungs, blood vessels,** vein, artery, capillary/ies, **blood, atria/atrium, ventricle/s, lifestyle, transport/ed**	**Pupils should be taught to:** • identify and name the main parts of the human circulatory system and describe the functions of the heart, blood vessels and blood • recognise the impact of diet, exercise, drugs, and lifestyle on the way their bodies function • describe the ways in which nutrients and water are transported within animals including humans • *Pupils should build on their learning from years 3 and 4 about the main body parts and internal organs (skeletal, muscular and digestive system) to explore and answer questions that help them to understand how the circulatory system enables the body to function.* • *Pupils should learn how to keep their bodies healthy and how their bodies might be damaged – including how some drugs and other substances can be harmful to the human body.*	**Pupils should be taught to:** • plan different types* of scientific enquiries to answer their own questions, including recognising and controlling variables where necessary. • use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate. • record data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar, and line graphs. • report and present findings from enquiries, including conclusions and causal relationships, in oral and written forms such as displays and other presentations, using appropriate scientific language. • explain degree of trust in results. • draw conclusions, explain and evaluate their methods and findings, communicating these in a variety of ways.

Implementation-activity examples and cultural capital opportunities	**Observing over time**
	• Pupils regularly take their pulse rate throughout the day.
	• Pupils keep an 'exercise diary' for a week.
	Key questions
	• **How does my heart rate change over the day?**
	• **How much exercise do I do in a week?**
	
	Pattern Seeking
	• Investigate the recovery rates for different groups of people.
	Key questions
	• **Do young people have quicker recovery rates than older people?**
	• **Do boys have a quicker recovery rate than girls?**
	
	Identifying and Classifying
	• Identify which parts of the human body make up the circulatory system.
	Key question
	• **Which organs of the body make up the circulation system, and where are they found?**
	
	Comparative and Fair Testing
	• Plan and carry out fair tests to investigate the effects of exercise on the human circulatory system (breathing/pulse rate) e.g.:
	  ○ The effect different types of exercise have on breathing/pulse rate.
	  ○ The effect that the length of exercise has on breathing/pulse rate.
	  ○ The effect that diet has on breathing/pulse rate.
	Key questions
	• **How does the length of time we exercise for affect our breathing/pulse rate?**
	• **Can exercising regularly affect your lung capacity?**
	• **Which type of exercise has the greatest effect on our breathing/pulse rate?**
	• **Does eating different types of food effect our breathing/pulse rate?**
	
	Researching using secondary sources
	• Research the function of the heart, blood vessels and blood.
	• Research how our knowledge and understanding of the human circulatory system has changed over time.
	• Research how our knowledge and understanding of the function of the heart/blood has changed over time?
	• Research the negative effects of drugs (e.g. tobacco) and the benefits of a healthy diet and regular exercise by asking an expert or using carefully selected secondary sources.
	• Research the ways in which nutrients and water are transported within animals including humans.

Key questions

- **What is the function of the heart, blood vessels and blood?**
- **What negative effects do drugs have?**
- **What are the benefits of a healthy diet/regular exercise?**
- **How has our knowledge and understanding of the human circulatory system changed over time?**
- **How has our knowledge and understanding of the function of the heart/blood changed over time?**

Exploring and Problem Solving

- Explore different ways or demonstrating/modelling the human circulatory system including drama and making a model.
- Explore different ways of demonstrating/modelling how the heart works.
- Explore the content of blood and how this can be represented using a model. An internet search about making a model to represent the make-up of blood will provide lots of ideas for how to do this.
- Explore the question, *What is a balanced diet for us and the planet?* See Explorify for more information, https://explorify.uk/en/activities/the-big-question/what-is-a-balanced-diet-for-us-and-the-planet
- Explore the question, *How can you help someone dance for 24 hours?* See Explorify for more information, https://explorify.uk/en/activities/the-big-question/how-can-you-help-someone-dance-for-24-hours
- Explore the question, *How could you measure the benefits of walking?* See Explorify for more information, https://explorify.uk/en/activities/the-big-question/how-could-you-measure-the-benefits-of-walking
- Based on their learning, challenge pupils to think of new questions they'd like to investigate about the human circulatory system – where possible enable them to do investigations to answer them.
- Explore what impact that calming activities (like reading, listening to calming music or meditating) has on pulse rates.

Key questions

- **How can we demonstrate how the human circulatory system works?**
- **How can we demonstrate how the heart works?**
- **How can we make a model to represent the different components of blood?**

Cultural capital opportunities:

Sustainable Development Goals: Number 3: good health and well-being.
Climate change links: Learn about how increases in global temperatures may impact on people's health and increase the spread of disease like malaria.
Visits/trips: A local health centre, sports centre or professional sports team.
Visitors: health professionals e.g. doctor, nurse, dietician, physiotherapist, sports professional including sports scientists, yoga teacher. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors
Scientists: Christian Barnard (heart transplant pioneer), William (the first person to correctly describe how the heart pumps blood around the body).

	Enrichment experiences: • Listen to their own and other's hearts using a stethoscope. Very simple stethoscopes can be made rolling A4 card into a tube and then using this to listen to a person's heart. • Dissect a pig's heart. See CLEAPSS for guidance, http://primary.cleapss.org.uk/Resource/GL135-Dissecting-hearts-in-primary-schools.aspx
Subject Links	**English** • Write a non-chronological report about the circulatory system. • Write a 'day in the life' diary entry for a blood cell. • Write arguments for/against introducing a ban on sugary snacks at school. Related texts • Pig-Heart Boy (Malorie Blackman) • Skellig (David Almond) • A Heart Pumping Adventure (Heather Manley) **Maths** • Calculate the average resting pulse of a group of people. • Calculate the average pulse rate of a group of people after exercise. • Identify the mode and median resting pulse rate for the class. • Present data relating to breathing/pulse rates in a line graph. • The average adult human heart weighs 310g. Pupils weigh out this amount and convert into pounds/ounces. • The human body contains on average 5.6 litres of blood. Pupils measure out this amount in water. • Pupils estimate how many times their heart has beaten so far in their lives. **Computing/Technology** • Present data relating to breathing/pulse rates in line graphs using Excel. **DT** • Make a model of the whole human circulatory system. • Make a model of the heart. **RE** • Discuss the ethics of organ transplants. *Should everyone be an organ donor? Should we use animals' organs in humans?*

	PSHE/Citizenship • This topic provides opportunities to explore the importance of staying fit and healthy in PSHE lessons and reinforce the core learning. **History** • Research how our knowledge and understanding of the human circulatory system has changed over time. • Research how our knowledge and understanding of the function of the heart/blood has changed over time? • Research the history of organ transplants. • Learn about the discoveries of the English doctor William Harvey. **PE** • Effects of exercise on breathing/pulse rate can be investigated during PE lessons.

Unit and Vocabulary	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Living things and their habitats **Prior vocabulary:** living, dead, never been alive, move, grow, change, feed, have offspring/young/ babies, adults, habitat, habitats (e.g. pond, meadow, ocean, urban, woodland, rainforest, micro-habitat (e.g. under a log, in a tree, on a field, under a bush etc), damp/wet/dry, dark/light, hot/warm/cool/cold, suited/suitable, basic needs, food (sources of), food chain, depend, shelter, classification keys, environment, deciduous, evergreen, fish, amphibian, reptile, bird, mammal, vertebrate, invertebrate, names of some invertebrates (eg ant, bee, fly, butterfly etc), offspring, babies, young, human impact (positive/negative), **New vocabulary:** **organism, micro-organism, bacteria, virus, fungi/fungus, mushroom, arachnid, mollusc, insect, crustacean**	**Pupils should be taught to:** • describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including microorganisms, plants and animals • give reasons for classifying plants and animals based on specific characteristics. • *Pupils should build on their learning about grouping living things in year 4 by looking at the classification system in more detail* . • *They should be introduced to the idea that broad groupings, such as micro-organisms, plants and animals can be subdivided.* • *Through direct observations where possible, they should classify animals into commonly found invertebrates (such as insects, spiders, snails, worms) and vertebrates (fish, amphibians, reptiles, birds and mammals).* • *They should discuss reasons why living things are placed in one group and not another. Pupils might find out about the significance of the work of scientists such as Carl Linnaeus, a pioneer of classification.*	**Pupils should be taught to:** • report and present findings from enquiries, including conclusions and causal relationships, in oral and written forms such as displays and other presentations, using appropriate scientific language.

Implementation-activity examples and cultural capital opportunities	**Observing over time** • Put a slice of bread or some raspberries into a sandwich bag and seal it. Make two pinpricks. Observe what happens. See CLEAPSS, 'Growing fungi on food' for health and safety guidance, http://primary.cleapss.org.uk/ Key question • **What happens to a piece of bread/raspberries (or other soft fruit) if you leave it on a windowsill for two weeks?** **Pattern Seeking** • Investigate invertebrates in different habitats within the school grounds. Identify patterns in where different invertebrates are found. • Investigate flowering plants and identify similarities/differences in their structure. Key questions • **Are there any patterns in where different types of invertebrates are found?** • **Do all flowers have the same number of petals?** **Identifying and Classifying** • Use first-hand observation to identify characteristics shared by the animals in a group. • Use information about the characteristics of an unknown animal or plant to assign it to a group. • Classify plants and animals, presenting this in a range of ways e.g., Venn diagrams, Carroll diagrams and keys. • Identify the different types of fungi/mould growing on a slice of bread/raspberries. • Identify mushrooms/toadstools in a wood. Remind pupils not to touch any. See The British Mycological Society for resources, https://www.britmycolsoc.org.uk/education/primary Key questions • **Based on your observations what characteristics do mammals/fish/birds etc have?** • **How would you make a classification key for vertebrates/invertebrates or microorganisms?** • **Based on these characteristics (of an unknown animal) which group would you assign it to?** • **How many mushrooms/toadstools can you spot in the woods?** **Comparative and Fair Testing** • Investigate invertebrates in different habitats within the school grounds. Key question • **Which is the most common invertebrate on our school playing field?** **Researching using secondary sources** • Research the characteristics of animals that belong to a group. • Research different types of microorganisms and how we have positive uses for some. • Research the formal classification system devised by Carl Linnaeus and why it is important.

	Key question • **What do different types of microorganisms do? Are they always harmful? Can microorganisms be good for you?** See Explorify, https://explorify.uk/en/activities/the-big-question/can-microorganisms-be-good-for-you **Exploring and Problem Solving** • Create an imaginary animal which has features from one or more groups. • Create a classification system for an imaginary alien planet. • Explore how some mammals have unusual backbones. See the relevant PSTT I Bet You Didn't Know article, https://pstt.org.uk/resources/curriculum-materials/cutting-edge-science-primary-schools • Based on their learning, challenge pupils to think of new questions they'd like to investigate about living things and their habitats – where possible enable them to do investigations to answer them. **Cultural capital opportunities:** **Sustainable Development Goals**: Numbers 14 & 15: Life below water and life on land. Number 13: climate action **Climate change links:** Pupils could learn about how climate change could lead to the mass extinction of many living things on Earth. **Visits/trips**: Local zoos/wildlife centres (e.g., Noah's Ark; Bristol Zoo; Cotswold Wildlife Park; Slimbridge Wetland Centre; Jenner's Museum (Berkley). **Visitors:** A biologist or zoologist. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Carl Linnaeus (classification system of all living things); Gregor Mendel (inheritance and genetics – based on plants); Robert Whittaker; Edward Jenner (vaccine for smallpox); Louis Pasteur (pasteurization); Alexander Fleming (antibiotics); Joseph Lister (antiseptic) **Enrichment experiences:** • Arrange for Zoolab, https://www.zoolabuk.com/ or a similar provider to visit. Local animal sanctuaries may bring animals for free or a small donation.
Subject Links	**English** • Write biographies about Carl Linnaeus or Gregor Mendel. Related texts • Beetle Boy (M G Leonard) • Insect Soup (Barry Louis Polisar) • Fur and Feathers (Janet Halfmann) • Joan Proctor, Dragon Doctor (Patricia Valdez) • Evelyn the Adventurous Entomologist (Christine Evans) • Shark Lady (Jess Keating) • Me… Jane (Patrick McDonnell)

- Life in the Ocean (Claire A. Nivola)
- Do You Love Bugs? (Matt Robertson)
- My Friend Earth, Patricia Maclachlan

Maths

- Place a quadrat onto different parts of the school field (and elsewhere in the school grounds). Pupils estimate what percentage/fraction is covered by different plants.
- Pupils carry out surveys of living things within the school grounds. They then calculate the percentage/fraction that:
  - were invertebrates/vertebrates
  - were insects, spiders, snails, and worms.

Computing/Technology

- Make branching databases to classify living things.
- Display data from surveys of living things using bar charts, line and scatter graphs.

PHSE

This topic provides opportunities in PSHE lessons to explore:

- The importance of caring for living things.
- The effects of climate change on biodiversity.
- How mouldy food may be harmful.

Geography

- Learn about living things and ecosystems in different parts of the world.

History

- Research the life and work of Carl Linnaeus and Gregor Mendel.

Unit and Vocabulary	Intent - statutory and non-statutory *(in italics)* content – Substantive (knowledge)	Intent –statutory and relevant non-statutory *(in italics)* content-Disciplinary (skills)
Evolution and Inheritance **Prior vocabulary:** suited/suitable, environment, offspring, fossils, **New vocabulary**: **evolution, inherit/inheritance, adapted, adaptation, characteristics, vary/variation**	**Pupils should be taught to:** • recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago • recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents • identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. • *Building on what they learned about fossils in the topic on rocks in year 3, pupils should find out more about how living things on earth have changed over time.* • *They should be introduced to the idea that characteristics are passed from parents to their offspring, for instance by considering different breeds of dogs, and what happens when, for example, labradors are crossed with poodles.* • *They should also appreciate that variation in offspring over time can make animals more or less able to survive in particular environments, for example, by exploring how giraffes' necks got longer, or the development of insulating fur on the arctic fox.* • *Pupils might find out about the work of palaeontologists such as Mary Anning and about how Charles Darwin and Alfred Wallace developed their ideas on evolution.*	**Pupils should be taught to:** • report and present findings from enquiries, including conclusions and causal relationships, in oral and written forms such as displays and other presentations, using appropriate scientific language. • identify and evaluate scientific evidence (their own and others') that has been used to support or refute ideas or arguments. • describe and evaluate their own and others' scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources.

Implementation-activity examples and cultural capital opportunities	**Observing over time** Pupils look at photographs/videos of horse skeletons which show how they have developed over a long period of time. See STEM Learning for more information, See https://www.youtube.com/watch?v=RdTO7e7gOtI for more information. Key question • **How has the skeleton of the horse changed over time?** **Pattern Seeking** • Give each child a 'stomach' (cup). Give each child a different 'beak' (e.g. A pair or tweezers, a spoon, a pair of scissors and a binder clip). Put some 'food' (paperclips) on the table and give the pupils two minutes to collect as many as they can and put them in their 'stomach'. Pupils then record how much 'food' they've been able to collect. Repeat for other types of 'food' (e.g., rubber bands, toothpicks, macaroni, marbles, mini-marshmallows). This activity is often called 'The Battle of the Beaks'. See STEM Learning for more information, https://www.stem.org.uk/resources/elibrary/resource/32696/battle-beaks Key question • **Is there a pattern between the size and shape of a bird's beak and the food it will eat?** **Identifying and Classifying** • Identify features in animals and plants that are passed on to offspring and explore this process by considering the artificial breeding of animals or plants e.g. dogs or wheat. Key question • **Compare the skeletons of apes, humans, and Neanderthals – how are they similar, and how are they different?** **Comparative and Fair Testing** • See the Pattern Seeking investigation above. Key question • **Which beak was able to collect the most/least amount of 'food'? Why?** **Researching using secondary sources** • Research the work of Mary Anning and how this provided evidence of evolution. • Research the work of Charles Darwin and Alfred Wallace and how this provided evidence for evolution. • Research dog breeds and how they came about. • Use secondary sources to find out about how the population of peppered moths changed during the industrial revolution. • Research how different animals/plants are adapted to suit different habitats. Key questions • **What happened when Charles Darwin visited the Galapagos islands?** • **What ideas did American geneticist Barbara McClintock have about genes that won her a Nobel Prize?** • **How were different dog breeds created?**

	Exploring and Problem Solving • Design a new plant or animal to live in a particular habitat. • Pupils create their own 'Flanimal'. For more information see the Flanimals book by Ricky Gervais. • Explore how humans might continue to evolve in response to environmental and technological change. • Explore the question, *How much variation is there in how we look?* See Explorify for more information, https://explorify.uk/en/activities/the-big-question/how-much-variation-is-there-in-how-we-look • Explore how bees and caterpillars can change the evolution of plants. See the relevant PSTT I Bet You Didn't Know article, https://pstt.org.uk/resources/curriculum-materials/cutting-edge-science-primary-schools • Learn about the evolution of life in cities. See the relevant PSTT I Bet You Didn't Know article, https://pstt.org.uk/resources/curriculum-materials/cutting-edge-science-primary-schools • Based on their learning, challenge pupils to think of new questions they'd like to investigate about evolution and inheritance – where possible enable them to do investigations to answer them. Key question • **What adaptations will your plant/animal need to survive in this habitat?** **Cultural capital opportunities:** **Sustainable Development Goals**: Numbers 14 & 15: Life below water and life on land. Number 13: climate action. **Climate change links:** Learn about how the speed of climate change means that huge numbers of animals and plants will not be able to adapt quickly enough to survive, leading to many becoming extinct. **Visits/trips**: A farm that has rare breeds. A local botanic garden. A natural history museum. **Visitors:** A biologist or geneticist. See STEM Ambassadors, https://www.stem.org.uk/stem-ambassadors **Scientists:** Charles Darwin and Alfred Russel Wallace (Theory of Evolution by Natural Selection) Jane Goodall (Chimpanzees), Mary Anning (pioneering palaeontologist). **Enrichment experiences:** Observe and handle fossils.
Subject Links	**English** • Pupils in the character of Charles Darwin/Mary Anning write a diary entry about a significant discovery/observation that they've made. Related texts • One Smart Fish (Christopher Wormell) • The Molliebird (Jules Pottle) • Our Family Tree (Lisa Westberg Peters) • Moth (Isabel Thomas) ○ **What coloured moths would be best camouflaged in our school environment?** • The Arrival (Shaun Tan)

	• Dogs (Emily Gravett) • What Mr Darwin Saw (Mick Manning) • Me… Jane (Patrick McDonnell) **Maths** • For the Battle of the Beaks activity pupils could calculate the group/class average that each 'beak' collects for each type of 'food'. **DT** • Pupils could make models of living things that they have designed to live in different habitats. • Pupils could make their own 'Flanimal'. **(Pre)History** • Learn about the development of life on Earth. See 'The Big Jurassic Classroom' on the PSTT website for supporting resources, https://pstt.org.uk/resources/curriculum-materials/big-jurassic-classroom **Art** • Draw hybrid species of animals or new breeds of dogs, labelling their features. **PE** • Sport related evolution resources can be found at the 'City of Stars', PSTT resource, https://pstt.org.uk/resources/curriculum-materials/city-science-stars

Criteria to assess readiness for next year group	**Working to the expected standard:** **Working scientifically** The pupil can, using appropriate scientific language from the national curriculum: • describe and evaluate their own and others' scientific ideas related to topics in the national curriculum (including ideas that have changed over time), using evidence from a range of sources • ask their own questions about the scientific phenomena that they are studying, and select the most appropriate ways to answer these questions, recognising and controlling variables where necessary (i.e., observing changes over different periods of time, noticing patterns, grouping, and classifying things, carrying out comparative and fair tests, and finding things out using a wide range of secondary sources) • use a range of scientific equipment to take accurate and precise measurements or readings, with repeat readings where appropriate • record data and results using scientific diagrams and labels, classification keys, tables, scatter graphs, bar, and line graphs • draw conclusions, explain, and evaluate their methods and findings, communicating these in a variety of ways • raise further questions that could be investigated, based on their data and observations. **Science content** The pupil can: • name and describe the functions of the main parts of the digestive [year 4], musculoskeletal [year 3] and circulatory systems [year 6]; and describe and compare different reproductive processes and life cycles in animals [year 5] • describe the effects of diet, exercise, drugs, and lifestyle on how the body functions [year 6] • use the observable features of plants, animals, and micro-organisms to group, classify and identify them into broad groups, using keys or other methods [year 6] • use the basic ideas of inheritance, variation, and adaptation to describe how living things have changed over time and evolved [year 6]; and describe how fossils are formed [year 3] and provide evidence for evolution [year 6] • group and identify materials [year 5], including rocks [year 3], in different ways according to their properties, based on first-hand observation; and justify the use of different everyday materials for different uses, based on their properties [year 5] • identify and describe what happens when dissolving occurs in everyday situations; and describe how to separate mixtures and solutions into their components [year 5] • identify, with reasons, whether changes in materials are reversible or not [year 5] • use the idea that light from light sources, or reflected light, travels in straight lines, and enters our eyes to explain how we see objects [year 6], and the formation [year 3], shape [year 6] and size of shadows [year 3] • describe the effects of simple forces that involve contact (air and water resistance, friction) [year 5], that act at a distance (magnetic forces, including those between like and unlike magnetic poles) [year 3], and gravity [year 5] • identify simple mechanisms, including levers, gears, and pulleys, that increase the effect of a force [year 5]

	• use simple apparatus to construct and control a series circuit, and describe how the circuit may be affected when changes are made to it; and use recognised symbols to represent simple series circuit diagrams [year 6] • describe the shapes and relative movements of the Sun, Moon, Earth, and other planets in the solar system; and explain the apparent movement of the sun across the sky in terms of the Earth's rotation and that this results in day and night [year 5].