

CITY OF
ROCHESTER



SCHOOL

City of Rochester School

Science Curriculum

Science Curriculum Key Stage 1 – 4

Intent

- At City of Rochester school we believe that a high quality science education provides the foundations for understanding the world through the specific disciplines of biology, chemistry and physics. Science has changed our lives and is vital to the world's future prosperity, and all pupils should be taught essential aspects of the knowledge, methods, processes and uses of science.
- Through building up a body of key foundational knowledge and concepts, pupils should be encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.
- Science in our school is about developing pupil's ideas and ways of working that enable them to make sense of the world in which they live through investigation, as well as using and applying process skills. We want to ensure that all pupils are exposed to high quality teaching and learning experiences, which allow pupils to explore their outdoor environment and locality, thus developing their scientific enquiry and investigative skills.
- They are supported with scientific vocabulary, which aids children's knowledge and understanding not only of the topic they are studying. but of the world around them.

Implementation

- In ensuring high standards of teaching and learning in science, we implement a curriculum that is progressive throughout the whole school.
- Science is taught as discrete units and lessons to ensure coverage.
- We use Learning Means The World, Entry Level Certificate (and where appropriate GCSE units) to help us in planning Science. These units have been created to develop children's enthusiasm for and knowledge/understanding of science. With a key emphasis on hands-on learning, pupils develop their investigation skills while securing their grasp of key scientific principles. Pupils will have the opportunity to discover more about famous scientists and their discoveries, deepening their own understanding as they do so. Through these engaging and in-depth units, children will foster a love of science and ensure complete curriculum coverage
- Staff have access to a support programme which enables them to meet the individual needs of pupils in relation to their diagnosis of ASD and together with subject specific/curriculum Knowledge.

Impact

- The impact and measure of this is to ensure pupils not only acquire the appropriate age related knowledge linked to the science curriculum, but also skills which equip them to progress from their starting points, and within their everyday lives.
- Attainment is measured using SOLAR and is designed for continuous use. Teachers record the small steps pupils make and use these steps to build a bigger picture of the pupils' learning and achievements.
- Assessment is completed at the end of every unit and is accumulative for the student's course.
- Regular feedback is sought from pupils through the School Council (half-termly), pupil surveys, (termly), parent surveys (annually), staff surveys (annually)
- Confidence, Resilience and Success are core values at City of Rochester School. This means that the acquisition of social skills and personal development are of paramount importance to our pupils to life beyond school. Impact is therefore demonstrated through social and linguistic development which the school evidences through case studies.
- Pupils have significant barriers to learning which the school works hard to help pupils overcome. This means that the school works with a wide variety of partners such as medical professionals, curriculum partners, parents/carers, education professionals and the wider community to promote pupils engagement in learning.

Statutory Guidance – Science

The national curriculum for science aims to ensure that all pupils:

- develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future

Links To Other Subjects

The provision for the use of ICT and Maths in science is excellent. The pupils are given the opportunity to research, plan, predict, test, calculate and improve their ideas using relevant ICT and Maths resources to improve understanding, aid communication and enhance presentation.

Communicating information

- ICT is used to express and communicate their findings to others through drawings, graphs, writing, e-mail, etc.
- Pupils are given opportunities to interpret data from charts, graphs, diagrams and formula in maths.
- They need not always have generated the information for themselves.

Handling Information

- Through the use of databases and spreadsheets pupils are encouraged to collect and present information in an ordered manner to answer questions and interpret results.

Modelling and Experimental work

- The use of computer simulations encourages pupils to recognise the patterns in data.
- Use video or CD-rom to study models.
- Simulation software to investigate components in a circuit.

Measurement and Control

- Use of sensors to detect sounds, light levels or record temperature changes.
- Data logging to allow for exploration of reliable data, identification of patterns and analysis of detailed data.

Applications and Effects

- Awareness of a variety of instruments to enhance observations and measurements.
- Extend their ability to identify resources which may be useful to them, including tape recorders and digital cameras.
- Encourage understanding of the limitations of scientific evidence and the need to question the accuracy of displayed information.

Links are also made to our experiential curriculum.

Careers Education

This subject links to careers education through discussion, information sharing and practical activities and experiences. These opportunities can lead to a better understanding of the further study options, training and work placements available in this field.

Learning in this subject may lead to possible careers in the following areas:

An understanding of chemistry could lead to a career as a pharmacist or pharmacy assistant.

An understanding of animal biology and physiology and anatomy could lead to a career in animal care; including vet nursing and equine husbandry.

An understanding of physics and mechanics could lead to a varied career in product design for engineering companies.

Working scientifically would provide the skills needed to develop a career as a laboratory technician across a variety of fields.

The cosmetics and beauty industry requires an understanding of human biology and the interaction of chemicals across the industry.

Curriculum Overview

- * Our curriculum is designed with our pupils in mind but is subject to change. Units may be moved around to suit pupil's interests, current affairs and to make better use of resources. If this happens staff ensure that there is breadth and balance across the year to ensure coverage.

KS1/2

In key stages 1 and 2 Science is taught directly through thematic units as part of the Learning Means The World curriculum. Science is taught through working scientifically (involving practical investigation, observation and application skills, enquiry, and research) alongside specific taught subject knowledge. Learning takes place both inside and outside the classroom. The topics are linked with the relevant pathway.

| | Term 1 | Term 2 | Term 3 | Term 4 | Term 5 | Term 6 |
|--------------------|-----------------|------------------------------|-------------------------------------|------------------------|---|---|
| Pathfinders | Living things | Light and Electricity | Light and Electricity | Working Scientifically | The sun, light and heat | The sun, light and heat |
| Adventurers | Electricity | Light | Rocks and Soils States of matter | Forces | Sound | Sound |
| Navigators | Earth and Space | Living things and adaptation | Animals including humans | Working Scientifically | Properties of Materials and The environment | Properties of Materials and The environment |

Pathfinders

| Term 1 | Term 2/Term 3 | Term 4 | Term 5 / Term 6 |
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| Science <i>Living Things</i> I can explore and observe in order to collect data and describe and compare findings. With help, I can suggest some ideas and questions and predict what might happen. | Science <i>Light and Electricity</i> I can observe and name a variety of sources of light, including electric lights, flames, and the sun. I know that fire has been used throughout history for cooking and lighting. | Science <i>Working Scientifically</i> I can explore and observe in order to collect data and describe and compare findings. With help, I can suggest some ideas and questions and predict what might happen. | Science <i>The sun, light and heat</i> I can explore and observe in order to collect data and describe and compare findings. With help, I can suggest some ideas and questions and predict what might happen. I can use first-hand observation, own experience and simple information sources to make comparisons and |

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| <p>I can use first-hand observation, own experience and simple information sources to make comparisons and answer questions.</p> <p>I can observe closely using simple equipment.</p> <p>I can recognise ways in which evidence can be collected.</p> <p>I can use simple scientific language.</p> <p>I can perform simple tests.</p> <p>I can record findings in various formats using standard units, drawings, diagrams, photographs, simple prepared formats such as tables and charts, tally charts, and displays.</p> <p>I can say whether what happened was what was expected and draw simple conclusions to help answer questions.</p> <p>I know the difference between living things and things that have never been alive.</p> <p>I can identify and name a variety of birds.</p> <p>I know that humans and other animals can produce offspring and that these offspring can grow into adults</p> | <p>I know about simple circuits involving batteries, wires, bulbs and other components</p> <p>I know that a switch can be used to break a circuit.</p> | <p>I can use first-hand observation, own experience, and simple information sources to make comparisons and answer questions.</p> <p>I can observe closely using simple equipment.</p> <p>I can recognise ways in which evidence can be collected.</p> <p>I can use simple scientific language.</p> <p>I can perform simple tests.</p> <p>I can record findings in various formats using standard units, drawings, diagrams, photographs, simple prepared formats such as tables and charts, tally charts, and displays.</p> <p>I can say whether what happened was what was expected and draw simple conclusions to help answer questions.</p> <p>I can compare how different things move.</p> <p>I can observe and describe how things are moving, using simple comparisons such as faster and slower.</p> <p>I understand that there are many kinds of sound and sources of sound.</p> <p>I know that sounds get fainter as the distance from the sound source increases.</p> | <p>answer questions.</p> <p>I can observe closely using simple equipment.</p> <p>I can recognise ways in which evidence can be collected.</p> <p>I can use simple scientific language.</p> <p>I can perform simple tests.</p> <p>I can record findings in various formats using standard units, drawings, diagrams, photographs, simple prepared formats such as tables and charts, tally charts, and displays.</p> <p>I can say whether what happened was what was expected and draw simple conclusions to help answer questions.</p> <p>I recognise that we need light in order to see things and that dark is the absence of light.</p> <p>I know, can name and observe a variety of sources of light, including electric lights, flames and the sun.</p> <p>I recognise that light from the sun can be dangerous and that there are ways to protect my eyes.</p> <p>I understand that the sun provides energy, and that solar power is a sustainable energy source.</p> <p>I am aware of simple ways to save electricity.</p> <p>I know that shadows are formed when the light from a light source is blocked by a solid object.</p> <p>I understand the term 'nocturnal' and know the names of some nocturnal animals</p> |
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| <p>Science <i>Living Things</i></p> <p>I can explore and observe in order to collect data and describe and compare findings.</p> <p>With help, I can suggest some ideas and questions and predict what might happen.</p> | <p>Science <i>Light and Electricity</i></p> <p>I can observe and name a variety of sources of light, including electric lights, flames, and the sun.</p> <p>I know that fire has been used throughout history for cooking and lighting.</p> | <p>Science <i>Working Scientifically</i></p> <p>I can explore and observe in order to collect data and describe and compare findings.</p> <p>With help, I can suggest some ideas and questions and predict what might happen.</p> | <p>Science <i>The sun, light and heat</i></p> <p>I can explore and observe in order to collect data and describe and compare findings.</p> <p>With help, I can suggest some ideas and questions and predict what might happen.</p> <p>I can use first-hand observation, own experience and simple information sources to make comparisons and</p> |
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| <p>I can use first-hand observation, own experience and simple information sources to make comparisons and answer questions.</p> <p>I can observe closely using simple equipment.</p> <p>I can recognise ways in which evidence can be collected.</p> <p>I can use simple scientific language.</p> <p>I can perform simple tests.</p> <p>I can record findings in various formats using standard units, drawings, diagrams, photographs, simple prepared formats such as tables and charts, tally charts, and displays.</p> <p>I can say whether what happened was what was expected and draw simple conclusions to help answer questions.</p> <p>I know the difference between living things and things that have never been alive.</p> <p>I can identify and name a variety of birds.</p> <p>I know that humans and other animals can produce offspring and that these offspring can grow into adults</p> | <p>I know about simple circuits involving batteries, wires, bulbs and other components</p> <p>I know that a switch can be used to break a circuit.</p> | <p>I can use first-hand observation, own experience, and simple information sources to make comparisons and answer questions.</p> <p>I can observe closely using simple equipment.</p> <p>I can recognise ways in which evidence can be collected.</p> <p>I can use simple scientific language.</p> <p>I can perform simple tests.</p> <p>I can record findings in various formats using standard units, drawings, diagrams, photographs, simple prepared formats such as tables and charts, tally charts, and displays.</p> <p>I can say whether what happened was what was expected and draw simple conclusions to help answer questions.</p> <p>I can compare how different things move.</p> <p>I can observe and describe how things are moving, using simple comparisons such as faster and slower.</p> <p>I understand that there are many kinds of sound and sources of sound.</p> <p>I know that sounds get fainter as the distance from the sound source increases.</p> | <p>answer questions.</p> <p>I can observe closely using simple equipment.</p> <p>I can recognise ways in which evidence can be collected.</p> <p>I can use simple scientific language.</p> <p>I can perform simple tests.</p> <p>I can record findings in various formats using standard units, drawings, diagrams, photographs, simple prepared formats such as tables and charts, tally charts, and displays.</p> <p>I can say whether what happened was what was expected and draw simple conclusions to help answer questions.</p> <p>I recognise that we need light in order to see things and that dark is the absence of light.</p> <p>I know, can name and observe a variety of sources of light, including electric lights, flames and the sun.</p> <p>I recognise that light from the sun can be dangerous and that there are ways to protect my eyes.</p> <p>I understand that the sun provides energy, and that solar power is a sustainable energy source.</p> <p>I am aware of simple ways to save electricity.</p> <p>I know that shadows are formed when the light from a light source is blocked by a solid object.</p> <p>I understand the term 'nocturnal' and know the names of some nocturnal animals</p> |
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Adventurers

| <u>Term 1</u> | <u>Term 2</u> | <u>Term 3</u> | <u>Term 4</u> | <u>Term 5 / 6</u> |
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| <p>Science Electricity</p> <p>I can set up and carry out simple practical enquiries, comparative, and fair tests, putting forward ideas about testing and making predictions. I can make close</p> | <p>Science Light</p> <p>I know that light is reflected from surfaces. I can find patterns in the way that the size of shadows changes</p> | <p>Rocks and Soils States of Matter</p> <p>Set up and carry out simple practical enquiries, comparative and fair tests Put forward ideas about testing and make predictions</p> | <p>Science Forces</p> <p>I can ask relevant questions and with help, set up and carry out simple practical enquiries, comparative and fair tests. I can suggest what might happen in comparative and fair tests.</p> | <p>Science Sound</p> <p>I can identify how sounds are made, associating some of them with something vibrating.</p> <p>I know that vibrations from sounds travel through a medium to the ear and can</p> |

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| <p>observations and comparisons, recognising patterns and suggesting explanations. I can identify simple trends to answer questions. I can use scientific evidence to answer questions. I can use a range of equipment, including data loggers and thermometers. I can gather and record findings through drawings, photographs, labelled diagrams, keys, models, presentations, tables, graphs and displays, using scientific language. I can use results to draw simple conclusions, suggest improvements and raise further questions</p> | | <p>Make close observations and comparisons Observe patterns and suggest explanations Collect data Recognise and explain why a test is fair or unfair Identify simple trends to answer questions</p> <p>Make accurate measurements using standard units and begin to think about why measurements should be repeated Use scientific evidence to answer questions</p> <p>Use a range of equipment, including data loggers and thermometers</p> <p>Gather and record findings through drawings, photographs, labelled diagrams, keys,</p> | <p>I can make careful observations and comparisons. I can recognise what constitutes a fair test. I can identify simple patterns, changes, similarities and differences. I can make measurements using standard units. I can discuss and describe findings. I can communicate findings using simple scientific language in written explanations, drawings, labelled diagrams, keys, bar charts or tables. I can use results to draw simple conclusions.</p> | <p>recognise patterns between the volume of a sound and the strength of the vibrations that produced it.</p> <p>I can identify patterns between the pitch of a sound and features of the object that produced it.</p> |
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Navigators

| <u>Term 1</u> | <u>Term 2 / 3</u> | <u>Term 3</u> | <u>Term 4</u> | <u>Term 5 / 6</u> |
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| <p>Science Earth and Space I can select and plan the most appropriate type of scientific enquiry to answer specific questions. I can make predictions based on scientific knowledge and understanding.</p> | <p>Science Living Things and Adaptation I know the differences in the life cycles of a mammal, an amphibian, an insect and a bird, recognising that living things produce offspring of the same kind, but normally offspring vary and are not identical to</p> | <p>Science Animals including humans To know and describe the changes as humans develop to old age To recognise the impact of diet, exercise, drugs and</p> | <p>Science Properties of materials and The environment I can make predictions based on scientific knowledge and understanding. I can recognise and control variables where appropriate during investigations and can take measurements using a range of scientific equipment with accuracy and precision.</p> | <p>Science Properties of materials and The environment I know that some changes result in the formation of new materials, and that this kind of change is not usually reversible. I can compare and group together everyday materials based on evidence</p> |

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| <p>I can identify scientific evidence that has been used to support or refute ideas.</p> <p>I can select information from a range of sources.</p> <p>I can record data and results of increasing complexity, using scientific diagrams and labels, classification keys, tables, bar and line graphs, and models, making appropriate use of ICT.</p> <p>I can present reports of findings in written form, displays and presentations.</p> <p>I know that the Sun, Earth and Moon are approximately spherical bodies.</p> <p>I know about and explain the movement of the Earth relative to the Sun in the solar system.</p> <p>I can use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.</p> <p>I know about and explain the movement of the Moon relative to the Earth.</p> | <p>their parents. I can describe the life process of reproduction in some plants and animals.</p> <p>I can describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences and can classify plants and animals based on specific characteristics and give reasons.</p> <p>I know and can identify how animals and plants are adapted to suit their environment in different ways, and that adaptation may lead to evolution.</p> | <p>lifestyle on the way their bodies function</p> <p>To identify and name the main parts of the human circulatory system, and explain the functions of the heart, blood vessels and blood</p> <p>To describe the ways in which nutrients and water are transported within animals, including humans.</p> | <p>I can record data and results of increasing complexity, using scientific diagrams and labels, classification keys, tables, bar and line graphs, and models, making appropriate use of ICT.</p> <p>I can report findings from investigations, including written explanations of results, explanation involving causal relationships, and conclusions.</p> <p>I can use test results to make predictions and set up further comparative and fair tests</p> | <p>from comparative and fair tests, including their hardness, solubility, conductivity (electrical and thermal), and response to magnets.</p> <p>I can suggest how mixtures might be separated, including through filtering, sieving and evaporating, use my knowledge of solids, liquids and gases. I can demonstrate that dissolving, mixing and changes of state are often reversible changes.</p> <p>I understand how some materials will dissolve in liquid to form a solution and can describe how to recover a substance from a solution.</p> <p>I show understanding by giving reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials (including metals, wood and plastic).</p> |
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Primary Science– Trialling the following curriculum from September 2023 as a precursor/preparation for the Entry level course.

Lower Primary

| Term 1 | Term 2 | Term 3 | Term 4 | Term 5 | Term 6 |
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| Animals (including Humans) | States of Matter | Chemicals (Working Scientifically) | Materials | Space | Ecosystems |

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| <p>identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals</p> <p>identify and name a variety of common animals that are carnivores, herbivores and omnivores</p> <p>describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals including pets)</p> <p>identify, name, draw and label the basic parts of the human body and say which part of the body is associated with each sense</p> <p>To observe animals in their local environment</p> <p>To compare, sort and group a variety of animals</p> | <p>distinguish between an object and the material from which it is made</p> <p>identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock</p> <p>describe the simple physical properties of a variety of everyday materials</p> <p>compare and group together a variety of everyday materials on the basis of their simple physical properties</p> <p>Perform scientific tests to explore materials</p> | <p>To carry out a range of scientific enquiries</p> <p>To ask simple questions</p> <p>To answer simple questions in different ways</p> <p>To observe closely, using simple equipment</p> <p>To perform simple tests</p> <p>Identify and classify items and objects</p> <p>suggest answers to questions using their observations and ideas</p> <p>gather and record data to help in answering questions</p> <p>To discuss what they have found out</p> <p>To talk about what they have found out</p> | <p>distinguish between an object and the material from which it is made</p> <p>identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock</p> <p>describe the simple physical properties of a variety of everyday materials</p> <p>compare and group together a variety of everyday materials on the basis of their simple physical properties</p> <p>Perform scientific tests to explore materials</p> <p>find out how the shapes of solid objects made from some materials can be changed by squashing, bending, twisting and stretching</p> | <p>To describe different humans who have contributed to discoveries in space</p> <p>To name the planets of the solar system</p> <p>To identify different star constellations</p> <p>To describe different ways to observe space</p> <p>To describe how the Earth orbits and rotates</p> <p>To compare day and night observe and describe weather associated with the seasons and how day length varies</p> | <p>Identify a variety of common wild plants</p> <p>Identify a variety of common garden plants</p> <p>Identify a variety of trees</p> <p>To observe the growth of plants, flowers and vegetables</p> <p>To explore the local environment for plants</p> <p>To name parts of a plant including leaves, flowers (blossom), petals, fruit, roots, bulb, seed, trunk, branches, stem.</p> <p>To keep a record of how plants change over time. observe and describe how seeds and bulbs grow into mature plants</p> <p>find out and describe how plants need water, light and a suitable temperature to grow and stay healthy</p> <p>observe changes across the 4 seasons</p> <p>explore and compare the differences between things that are living, dead, and things that have never been alive</p> <p>identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and</p> |
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| | | | | | <p>plants, and how they depend on each other</p> <p>identify and name a variety of plants and animals in their habitats, including microhabitats</p> <p>describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food</p> |
| Links to: The Human Body | Links to: States of Matter | Links to: Light and Sound | Links to: Materials | Links to: Space | Links to: Ecosystems |

Upper Primary

Rotation 1

| Term 1 | Term 2 | Term 3 | Term 4 | Term 5 | Term 6 |
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| The Human Body | States of Matter | Light and Sound | Materials | Space | Ecosystems |
| <ul style="list-style-type: none"> identify and name the main parts of the human circulatory system describe the functions of the heart, blood vessels and blood. identify that humans and some other animals have skeletons and muscles for support, protection and movement. | <ul style="list-style-type: none"> compare and group materials together, according to whether they are solids, liquids or gases observe that some materials change state when they are heated or cooled. Understand how evaporation, condensation, melting and freezing change the state of matter. | <ul style="list-style-type: none"> identify how sounds are made, associating some of them with something vibrating recognise that vibrations from sounds travel through a medium to the ear and recall the structure of the ear find patterns between the volume of a sound and the strength of the vibrations that produced it | <ul style="list-style-type: none"> identify and compare the suitability of a variety of everyday materials, including wood, metal, plastic, glass, brick, rock, paper and cardboard for particular uses find out how the shapes of solid objects made from some materials can be changed. compare and group together everyday | <ul style="list-style-type: none"> describe the movement of the Earth, and other planets, relative to the Sun in the solar system describe the movement of the Moon relative to the Earth describe the Sun, Earth and Moon as approximately spherical bodies use the idea of the Earth's rotation to explain day and | <ul style="list-style-type: none"> explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including |

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| <ul style="list-style-type: none"> Identify and name the main parts of the respiratory system. Identify and name the parts of the eye. Identify and name the parts of the ear. Understand that cells are the building blocks of life. Understand how the body responds when we are unwell and how to stay healthy. describe the life process of reproduction in some animals including humans. | <ul style="list-style-type: none"> identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating demonstrate that dissolving, mixing and changes of state are reversible changes explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible. | <ul style="list-style-type: none"> Know that sound travels in waves. Identify how sound waves change with changes in pitch, volume and frequency. recognise that you need light in order to see things and that dark is the absence of light notice that light is reflected from surfaces recognise that light from the sun can be dangerous and that there are ways to protect their eyes recognise that shadows are formed when the light from a light source is blocked by a solid object recognise that light appears to travel in straight lines 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. Describe the spectrum of light. | <p>materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets</p> <ul style="list-style-type: none"> give reasons for the particular uses of everyday materials, including metals, wood and plastic compare and group together different kinds of rocks on the basis of their appearance and simple physical properties. describe in simple terms how fossils are formed when things that have lived are trapped within rock recognise that soils are made from rocks and organic matter. | <p>night and the apparent movement of the sun across the sky.</p> <ul style="list-style-type: none"> Describe how light moves through space. Explain what we see when we are looking at the stars. Explore different rockets that have gone into space identify how they were powered. | <p>micro-organisms, plants and animals</p> <ul style="list-style-type: none"> describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird describe the life process of reproduction in some plants. to living things. identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. explore the requirements of plants for life and growth (air, light, water, nutrients from soil and room to grow) and how they vary from plant to plant explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. recognise that environments can change and that this can sometimes pose dangers |
| <p>Links to OCR Entry Level: ELB1 ELB2 ELB3 ELB4 ELB5 ELB6</p> | <p>Links to OCR Entry Level: ELC1 ELC4 ELC6 ELC5</p> | <p>Links to OCR Entry Level: ELP1 ELP2 ELP3</p> | <p>Links to OCR Entry Level: ELC8</p> | <p>Links to OCR Entry Level: ELP11 ELP12</p> | <p>Links to OCR Entry Level: ELB9</p> |

| Term 1 | Term 2 | Term 3 | Term 4 | Term 5 | Term 6 |
|--|---|--|--|---|---|
| Forces and Magnets | Food and Digestion | Electricity | Energy | Chemicals (Working Scientifically) | Evolution and Our genes |
| <p>Pushes and pulls</p> <ul style="list-style-type: none"> compare how things move on different surfaces notice that some forces need contact between two objects, but magnetic forces can act at a distance observe how magnets attract or repel each other and attract some materials and not others compare and group together a variety of everyday materials on the basis of whether they are attracted to a magnet, and identify some magnetic materials describe magnets as having two poles predict whether two magnets will attract or repel each other, depending on which poles are facing. explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object identify the effects of air resistance, water resistance and friction, that act between moving surfaces | <ul style="list-style-type: none"> identify that animals, including humans, need the right types and amount of nutrition, and that they cannot make their own food; they get nutrition from what they eat 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. construct and interpret a variety of food chains, identifying producers, predators and prey. Know the main body parts associated with the digestive system, for example, mouth, tongue, teeth, oesophagus, stomach and small and large intestine and explore questions that help them to understand their special functions. identify the different types of teeth in humans and their simple functions | <ul style="list-style-type: none"> identify common appliances that run on electricity construct a simple series electrical circuit, identifying and naming its basic parts, including cells, wires, bulbs, switches and buzzers identify whether or not a lamp will light in a simple series circuit, based on whether or not the lamp is part of a complete loop with a battery recognise that a switch opens and closes a circuit and associate this with whether or not a lamp lights in a simple series circuit recognise some common conductors and insulators, and associate metals with being good conductors. associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit use recognised symbols when representing a simple circuit in a diagram. Understand electricity as the flow of electrons. | <ul style="list-style-type: none"> Sort and compare objects by their power source. Identify devices in the home which require power. Identify the different energy stores. Describe simple energy transfers. Identify different sources of power to our homes. Compare different sources of power to our homes and sort into renewable and non-renewable sources. Identify the sun as a source of energy Know that solar power is a sustainable energy source. Associate the greenhouse effect with burning fossil fuels. | <ul style="list-style-type: none"> planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs using test results to make predictions to set up further comparative and fair tests reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations identifying scientific evidence that has been used to support or refute ideas or arguments | <ul style="list-style-type: none"> recognise that living things have changed over time. Know 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 that our DNA “codes” for the traits we inherit. identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. |

| | | | | | |
|--|--|---|---|--|---|
| <ul style="list-style-type: none"> recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. | | | | | |
| Links to OCR Entry Level: ELP8 ELP9 ELP10 | Links to OCR Entry Level: ELB7 ELB12 | Links to OCR Entry Level: ELP6 ELP7 | Links to OCR Entry Level: ELP4 ELP5 ELP6 | Links to OCR Entry Level: ELC2 ELC3 ELC11 | Links to OCR Entry Level: ELB10 ELB11 |

KS3 / KS4 / KS5

Students in Key Stage 3/4/5 will study the OCR Science Entry Level Certificate and where appropriate GCSE.

This specification has been specifically designed to meet the need of those learners in Key Stage 3/4 for whom courses leading to a GCSE (9–1) examination may not represent a realistic or appropriate goal at this time. The specification can be used as the basis of an independent course for those learners identified as unlikely to be entered for GCSE (9–1) at this time. However, during the Entry Level Certificate some learners may show sufficient progress for them to be entered into a single science GCSE (9–1). To ensure that the KS4 programme of study is followed these learners may continue with the Entry Level qualification in the science subjects not being continued at GCSE (9–1). For example if a learner is following the GCSE (9–1) in Chemistry they may continue Entry Level Certificate in Biology and Physics The course can be started prior to KS4 if this is deemed appropriate.

The course material can also be used and as a source of support materials for the teaching of Foundation Tier of a GCSE (9–1) examination. The specification consists of 36 items, equally divided between biology, chemistry and physics. Learners do not need to have been assessed for all items in order to enter for certification. There is no minimum number of items required but it is expected that there is at least one item from biology, chemistry and physics.

There is no terminal examination, and assessment is by means of a combination of short end-of-item tests, can-do tasks and a practical task (see section 3f). All assessments are centre-based, are supervised by the learner’s own teacher, and are carried out at times determined by the centre. All assessments will be subject to standard moderation procedures by OCR.

Part of the inherent flexibility of the Entry Level Certificate in Science specification is the linking of the mark descriptors for the practical task to those for the practical activities for OCR Twenty First Century GCSE (9–1) Science and OCR Gateway GCSE (9–1) Science. This allows the possibility of progression from Entry Level Certificate in

Science to GCSE (9–1) Science. Learners making this progression can be entered, as late as February of Year 11, for the Foundation Tier of an OCR GCSE (9–1) Science qualification.

Course Overview:

Biology items

ELB1 Dead or Alive

ELB2 Babies (reproduction)

ELB3 Control systems

ELB4 Fooling your senses

ELB5 Gasping for breath

ELB6 Casualty

ELB7 You only have one life

ELB8 Body wars

ELB9 Creepy crawlies

ELB10 Extinction

ELB11 My genes

ELB12 Food factory

Chemistry items

ELC1 Physical or chemical change

ELC2 Acids and alkalis

ELC3 Everything in its place

ELC4 Clean air and water

ELC5 Novel materials

ELC6 Sorting out

ELC7 Let's get together

ELC8 Heavy metal

ELC9 Fuels

ELC10 Are you overreacting?

ELC11 How fast? How slow?

ELC12 CSI plus

Physics items

ELP1 Getting the message

ELP2 Full spectrum

ELP3 Medical rays

ELP4 Hot stuff

ELP5 Alternative energy

ELP6 Nuclear power

ELP7 Our electricity supply

ELP8 Attractive forces

ELP9 Pushes and pulls

ELP10 Driving along

ELP11 Fly me to the moon

ELP12 Final frontiers

The assessment is made up of three elements listed below. There is one assessment series each year in May/June

Element 1: End-of-item-tests 72% of the total 72 points Learners should submit a maximum of 36 tests. The marks for each test are converted into points. Each test is worth a maximum of two points.

Element 2: Can-do-tasks 8% of the total 8 points There are 16 can-do-tasks. For each task learners have done 0.5 can be awarded.

Element 3: Practical task 20% of the total 20 points Centres are able to devise their own practical task or use/adapt the GCSE (9–1) PAGs (see Section 5g). Learners can attempt more than one of these but the points must be awarded from one task.

(See course details below)

| ELB1 Dead or alive (cells) | | | | |
|----------------------------|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB1a | Recall the life processes: movement, respiration, sensitivity, growth, reproduction, excretion, and nutrition. | Discuss the processes of life and how we know that someone is still alive. Make up a mnemonic (e.g. Mrs Gren) to remember this. | | |
| ELB1b | Be able to name the body systems involved with these life processes: circulatory, respiratory and digestive. | Build up systems to show organisation using diagrams of cells, tissues, organs, and systems. Look at the position of organs within the body. Stick cut-out organs into position on a body outline. | B2.2c | B5.1.3 |
| ELB1c | Be able to label the nucleus, cytoplasm and cell membrane of an animal cell. | Build simple 3D models to show and label an animal cell. | B1.1b | B1.1.a |
| ELB1d | Know that the nucleus controls the cell; the membrane allows some chemicals to pass in and out, and the cytoplasm is where useful chemical reactions take place. | http://www.ibiblio.org/virtualcell/index.htm (The cell.) | B1.1b | B1.1.a |
| ELB1e | Know that cells get substances in by diffusion, and active transport [No knowledge of the process is required]. | | B2.1a | B3.2.2a |
| ELB1f | Know that new cells are made when cells divide. | | B2.1b | B4.3.1 |
| ELB1g | Know that new body cells are needed for growth and repair. | | B2.1b | |
| ELB1h | Know that cancer can be caused when cell division is out of control. | | B6.3o | B4.3.1 |

| ELB1 Dead or alive (cells) | | | | |
|---|--|--------------------------------------|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB1i | Know that bigger organisms have cells that are adapted for different roles to include nerve cells/root hair cells/red blood cells. | | B2.1c | B4.3.5 |
| ELB1j | Know that stem cells are cells that can change into other cells. | | B2.1d | B4.3.4 |
| ELB1k | know that stem cells can be used in medicine to repair the body. | | B6.3p | B4.4.1 |
| Suggested can-do tasks: B4, U3, U4 | | Suggested PAG: B1 | | |

| ELB2 Babies (reproduction) | | | | |
|----------------------------|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB2a | Recall the names of the main organs of the female reproductive system: ovary, oviduct, womb, and vagina. | Label simple diagrams of male/female reproductive systems. | | |
| ELB2b | Recall the names of the main organs of the male reproductive system: penis, testis, sperm duct. | Discuss the role of male and female in sexual intercourse. Add arrows to a diagram of the female reproductive system to show direction of sperm movement towards the egg. | | |
| ELB2c | Recall the functions of testes (make sperm), ovary (make eggs). | | | |
| ELB2d | Recall that normal body cells have 46 chromosomes: females have 23 pairs (including xx); males have 22 pairs and an odd pair (xy). | Use a gene pairing game to show males have an odd set of chromosomes (xy) while females have (xx). | B5.1i | B1.2.8 |
| ELB2e | Know that sperm and egg cells have 23 chromosomes each. | | B5.1f | B4.3.3 |
| ELB2f | Know that fertilisation occurs by the fusion of a sperm and an egg cell, which produces a fertilised egg with 46 chromosomes. | Discuss what fertilisation involves, and how the egg can separate to form twins. | | |
| ELB2g | Recall that the fertilised egg develops into a foetus. | | | |

| ELB2 Babies (reproduction) | | | | |
|----------------------------|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB2h | Know that the placenta is the exchange surface used to transfer substances between the mother and foetus and what happens to it after child birth. | <p>Cut and stick work sheets to show positions of placenta, cord, foetus, bag of water.</p> <p>Complete a table to show the basic role of these structures.</p> | B2.2a | B5.1.7 |
| ELB2i | Know that chemicals called hormones are involved in reproduction to include male: testosterone and female: oestrogen and progesterone. | | B3.2a | B5.5.1 |
| ELB2j | Recall some of the changes that occur in the female body after fertilisation: stopping periods and gaining weight. | <p>Discuss the changes that take place in the female body after fertilisation.</p> <p>https://syllabus.med.unc.edu/courseware/embryo_images/unit-welcome/welcome_htms/akgs.htm (development of the embryo.)</p> | B3.2c | B5.5.1 |
| ELB2k | Know that periods start again after childbirth. | <p>Sequence statements of events of labour leading up to birth.</p> <p>Visit to clinic/midwife.</p> | | |
| ELB2l | Explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception. | | B3.2e | B5.5.3 |

| ELB3 Control systems | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB3a | Understand that changes in our surroundings can affect our body's internal environment. | Introduce the idea that our internal environment needs controlling. | | |
| ELB3b | Understand that the body's internal environment can change and that the body tries to control this change, use temperature regulation as an example. | Discuss changes in our surrounding environment which can affect our body's internal environment. | B3.3a | B5.4.1 |
| ELB3c | Know the ways the body gains or loses water. | Survey the amount of liquid drunk in summer and winter. | B2.2b | B5.1.1 |
| ELB3d | Be able to name and locate the kidneys and the bladder. | Label a simple diagram of a kidney and a bladder. Show/dissect a kidney. | | |
| ELB3e | Know that kidneys remove excess water and urea. | Discuss the use of isotonic liquids by athletes. | B2.2b | B5.1.1 |
| ELB3f | Know that blood sugar levels need to be controlled. | Read a story about a diabetic. | B3.3a | B5.6.1 |
| ELB3g | Know that the body controls blood sugar levels with insulin. | Discuss how being a diabetic affects your life. | B3.3c | B5.6.1 |
| ELB3h | Be able to name and locate the pancreas. | | | |
| ELB3i | Know that insulin is produced by the pancreas. | Design a leaflet to explain what being a diabetic means. | | |
| ELB3j | Know that diabetes can be managed by controlling sugar levels in the diet and use of insulin. | Discuss that there are two types of diabetes and that their treatment can be different. | B3.3e | B5.6.3 |
| Suggested can-do tasks: B1, B2, B4, U3, U4 | | Suggested PAG: B1 | | |

| ELB4 Fooling your senses | | | | |
|----------------------------|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB4a | Be able to label a diagram of the eye (limited to cornea, iris, pupil, lens, retina, optic nerve). | Look at a model/video/website of the structure of the eye. | B3.1a | B5.2.1 |
| ELB4b | Recall the job of the pupil, lens, retina, optic nerve and iris. | Build a cut and stick model of the eye. | B3.1a | B5.2.1 |
| ELB4c | Know that the nose is lined with nerves sensitive to chemicals in the air. | Identify substances by smell, e.g. different types of crisps. Taste food when the sense of smell is impaired, e.g. apple and onion. | B3.1a | B5.2.1 |
| ELB4d | Recall that taste buds are located on the tongue and are sensitive to four tastes: salt, sweet, sour, bitter. | Investigate the four taste areas on the tongue. | B3.1a | B5.2.1 |
| ELB4e | Know that different areas of the tongue are more sensitive to different tastes. | | B3.1b | B5.2.1 |
| ELB4f | Understand that the flavour of food diminishes when we have a cold and cannot smell. | | B3.1b | B5.2.1 |
| ELB4g | Know that sensor (receptor) cells detect stimuli, and effector cells (muscles) produce a response. | Watch a video/website simulation of how nerve impulses work. | B3.1b | B5.2.1 |
| ELB4h | Understand the need for simple reflex actions, i.e. for protection. | Investigate reflex reactions, e.g. knee jerk, pupil dilation and blinking. | B3.1b | B5.2.2 |
| ELB4i | Recall examples of simple reflex actions limited to knee jerk, iris, touching a hot surface. | | B3.1c | B5.2.2 |
| ELB4j | Interpret simple data on reaction times. | Measure reaction times by catching a dropped ruler. | B3.1c | B5.2.2 |

ELB4 Fooling your senses

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELB4k | Know that the skin contains sensory nerves for touch, temperature, pain and pressure. | Use 'feelie' boxes to test skin sensitivity. Test water temperature with the hands. | B3.1b | B5.2.2 |
| ELB4l | Know that pressure sensors are deeper than pain sensors. | | B3.1b | B5.2.2 |
| ELB4m | Know that some areas of skin contain more nerve endings than others. | Test different areas of skin for sensitivity. | B3.1b | B5.2.2 |

Suggested can-do tasks: B1, U1, U3, U4

ELB5 Gasping for breath

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELB5a | Be able to name and locate the windpipe, lungs and ribs on a diagram of the thorax. | Make a model thorax. | | |
| ELB5b | Understand that lung volumes vary and may be affected by smoking. | Measure lung volumes. | B6.3n | B2.4.2 |
| ELB5c | Understand that the speed of ventilation varies and may be affected by smoking. | Measure chest movement during breathing. Use a peak flow meter. | B6.3n | B2.4.2 |
| ELB5d | Know that smoking can cause heart disease and cancer. | Demonstrate a model smoking machine. | B6.3l | B2.4.1 |
| ELB5e | Recall that tobacco smoke contains carbon monoxide, nicotine, tars and solid particles. | Debate smoking in public places. | | |
| ELB5f | Know that carbon monoxide is odourless, colourless and poisonous. | Use websites/books to find out about smoking. | | |
| ELB5g | Know that nicotine is addictive and that nicotine patches can be used to help someone give up smoking. | | | |
| ELB5h | Interpret data relating to health studies on smoking. | | | |
| ELB5i | Know that other people may be affected by passive smoking. | | | |
| ELB5j | Know that in all cells, glucose from food and oxygen breathed in combine to release energy and that this process is called respiration. | Watch a video/simulation (e.g. www.bbc.co.uk/bitesize) to show respiration in cells. | B1.3a | B4.1.2 |
| ELB5k | Know that carbon dioxide and water are the waste products of respiration. | | B1.3a | B4.1.2 |

ELB5 Gasping for breath

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELB5l | Recall how to test breath for carbon dioxide using limewater, and for water vapour with a mirror or cobalt chloride paper. | | B2.2b | B5.1.1 |
| ELB5m | Know that carbon dioxide is removed from our bodies via the lungs. | Test exhaled air to show it contains carbon dioxide and water vapour. | B2.2b | B5.1.1 |
| ELB5n | Know that during exercise, more oxygen and glucose is needed by muscles, and water and carbon dioxide are removed more quickly. | Link exercise to respiration rate. | B2.2b | B5.1.1 |

Suggested can-do tasks: B1, B2, U1, U3, U4

| ELB6 Casualty | | | | |
|----------------------------|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB6a | Understand the importance of maintaining the supply of oxygen to the body. | Learn basic first aid for an emergency – video/St John Ambulance etc. Practise simple first aid techniques. Discuss how and when to call for help: making a 999 call. | B2.2b | B3.2.1 |
| ELB6b | Know that the heart is made of muscle. | Look at the structure of the heart (dissection or model). | B2.2d | B5.1.4 |
| ELB6c | Know that the heart pumps to force blood out to the lungs or around the body. | http://www.smm.org/heart/heart/top.html (the structure of the heart.) Different ways of measuring pulse rate including using a stethoscope, finger monitors, radial pulse etc. | B2.2d | B5.1.4 |
| ELB6d | Know that the heart acts as a double pump. | Show that in one complete circuit of the body blood goes through the heart twice. | B2.2d | B5.1.4 |
| ELB6e | Know that arteries carry blood away from the heart, and veins to the heart. | Discuss differences between arteries and veins and capillaries. | B2.2d | B5.1.5 |
| ELB6f | Be able to recognise the difference between an artery and a vein. | Look at microscope slides to show the structures of arteries veins and capillaries. | B2.2d | B5.1.5 |
| ELB6g | Know why the heart muscles need a good blood supply. | Look at the structure of the heart (dissection or model) and illustrate the coronary arteries. | B2.2d | B5.1.4 |
| ELB6h | Explain how red blood cells and plasma are adapted to their functions in the blood. | | B2.2e | B5.1.6 |
| ELB6i | Know that energy is needed for muscle contraction. | Carry out a simple exercise to show muscle fatigue (finger stretching an elastic band, or fist clenches with arm raises). | | |

| ELB6 Casualty | | | | |
|---|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB6j | Understand that during exercise muscles need to be supplied with more oxygen and be able to relate this to an increase in heart rate. | Find out how exercise affects breathing rate and pulse rate. Discuss the link between recovery time and fitness. | | |
| ELB6k | Know the equation for respiration. | glucose + oxygen → carbon dioxide + water. | | |
| ELB6l | Compare the processes of aerobic and anaerobic respiration to include the products of both reactions and their effects. | | B1.3c | B4.1.1 |
| ELB6m | Interpret simple data on breathing and pulse rates during exercise [no recall expected]. | Measuring the effect of exercise on pulse rate. | B2.2b | B5.1.1 |
| ELB6n | Understand that a cut to a major blood vessel is more serious than a cut to a capillary. | Discuss that the body can cope with a 10% blood loss and that a 30% blood loss is serious and that the casualty may need a blood transfusion. | B2.2d | B5.1.5 |
| ELB6o | Know that heart disease often happens when arteries supplying the heart with blood become blocked. | Look at health education leaflets and identify factors that increase the risk of heart disease. Explore heart disease risk factors for different individuals. | B6.3n | |
| ELB6p | Know that the risk of heart disease is increased by some factors including high-fat diet and smoking and understand that these factors increase the risk of heart disease, but will not cause it in everyone. | Consider patterns in evidence that smoking increases the risk of heart disease. Look at video material reporting studies of risk factors for heart disease. | B6.3m | |
| Suggested can-do tasks: B1, B4, U1, U3, U4 | | | | |

ELB7 You only have one life – look after it!

| EL science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|-------------------------|---|--|--|---|
| ELB7a | Know that being overweight or underweight is linked to increased health risks. | | B6.3n | B2.3.2 |
| ELB7b | Understand that regular exercise is important for a healthy lifestyle. | | B6.3m | B2.3.2 |
| ELB7c | Know that regular exercise reduces the risk of heart disease. | | B6.3m | B2.5.3 |
| ELB7d | Know that different people have different lifestyles and therefore dietary requirements. | | B6.3m | B2.4.2 |
| ELB7e | Understand, in simple terms, the processes of digestion and absorption and where these events occur. | Produce a full size model body with labelled cut-outs of the organs. | B2.1a | B5.1.3 |
| ELB7f | Know that enzymes speed up reactions in humans. | Model the enzyme 'lock and key' | B2.1d | B3.1.3a |
| ELB7g | Understand that enzymes speed up digestion to produce smaller soluble chemicals (which can pass into the blood by diffusion). | Discuss the role of enzymes in digestion. Show that large molecules (e.g. starch) cannot pass through visking tubing, while smaller molecules can (e.g. simple sugars). | B1.2d B2.1a B2.2a | B3.1.3a B3.2.2a |
| ELB7h | Know that there are different enzymes in the mouth, stomach and intestines, each of which digests a different type of food. | Show that only particular types of enzyme can digest certain foods, e.g. protease cannot digest starch. | | |
| ELB7i | Know that drugs can be beneficial or harmful. | Research the classification of drugs. | B6.3n | B2.4.2 |
| ELB7j | Know that a drug is a chemical that has an effect on the mind or the body. | | B6.3n | B2.4.2 |
| ELB7k | Know that some drugs are addictive. | Research ideas about making cannabis legal. | B6.3n | B2.4.2 |

ELB7 You only have one life – look after it!

| EL science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|---|--|--|--|---|
| ELB7l | Know how the effect of caffeine on heart rate can be measured. | Measure the effect of caffeine on heart rate e.g. in <i>Daphnia</i> . | B6.3n | B2.4.2 |
| ELB7m | Know that alcohol abuse accounts for more deaths and crime than any other drug. | | B6.3n | B2.4.2 |
| ELB7n | Know the short term effects of alcohol (limited to blurred vision, slurred speech, poor balance and slower reactions). | | B6.3n | B2.4.2 |
| ELB7o | Know the dangers of drink driving. | Research drink driving laws in different countries. Produce a poster on the dangers of drink driving. | | |
| ELB7p | Know the long term effects of alcohol (limited to liver damage). | | B6.3n | B2.4.2 |
| Suggested can-do tasks: B1, B2, U1, U2, U3, U4 | | Suggested PAGs: B1, B3 | | |

ELB8 Body wars

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELB8a | Describe the relationship between health and disease. | | B6.3a | B2.1.1 |
| ELB8b | Describe different types of diseases (including diseases that can be caught and those that cannot be caught). | Discuss diseases that can be caught and those that cannot e.g. cold and cancer. | B6.3b | B2.1.2 |
| ELB8c | Know that if you are infected with two diseases it may make you feel worse. | | B6.3c | B2.4.4 |
| ELB8d | Know that plants can get diseases too. | Show some examples of plant disease e.g. powdery mildew, tobacco mosaic virus disease and crown gall disease. | B6.3f B6.3e | B2.1.5 |
| ELB8e | Recall that harmful microbes (pathogens) are bacteria, fungi, protists and viruses. | Look at pictures of the microbes. | B6.3d | B2.1.3 |
| ELB8f | Describe a minimum of one common human infection plus a sexually transmitted infection in humans, including HIV/AIDS. | | B6.3f B6.3e | B2.3.1 B2.1.4 |
| ELB8g | Understand that our bodies provide good conditions for microbes to reproduce rapidly. | | | |
| ELB8h | Recall that the skin, chemicals in tears, sweat, and stomach acid stop microbes getting in. | Test the effect of acidic pH (stomach acid) or protease (tears) on growth of bacterial agar plates. | B6.3h | B2.2.1 |
| ELB8i | Know that microbes can enter the body through natural openings, or cuts in the skin. | | | |
| ELB8j | Know that white blood cells are part of the immune system. | | B6.3j | B2.2.3 |

ELB8 Body wars

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|---|--|---|--|---|
| ELB8k | Know that the immune system fights infections. | | B6.3j | B2.2.3 |
| ELB8l | With reference to infection explain how white blood cells, platelets and plasma are adapted to their functions in the blood. | | B6.3g | B2.2.4 |
| ELB8m | Describe the process of discovery and development of new medicines. | | B6.3k | B2.5.4 |
| ELB8n | Know that antibiotics are chemicals that kill bacteria and fungi, but not viruses. | Test the effect of antiseptics and/or antibiotic discs on growth of bacterial agar plate. | B6.3j | |
| ELB8o | Know that some bacteria have evolved which are not killed by some antibiotics. | | B5.2e | B6.1.5 B6.1.7 |
| ELB8p | Know that vaccines can make people immune to a disease. | Find out what vaccinations you have had. | B6.3j | B2.3.2 |
| ELB8q | Know that a vaccine usually contains a safe form of a disease-causing microorganism. | Discuss why vaccines are given – to protect the majority against a possible deadly disease. | B6.3j | B2.3.2 |
| ELB8r | Know that once you are immune you are protected from a particular disease. | | B6.3j | B2.3.2 |
| ELB8s | Understand different viewpoints that parents may have about giving their child a vaccination. | Discuss why some parents don't have their children vaccinated (risk of side effects). | B6.3j | B2.3.2 |
| ELB8t | Understand that media reports of health studies are not always accurate. | Match changing media headlines about the MMR vaccine over time to different pieces of evidence (source from the web). | B6.3j | B2.3.2 |
| Suggested can-do tasks: B1, B2, U1, U3, U4 | | Suggested PAGs: B1, B5 | | |

ELB9 Creepy crawlies

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELB9a | Know that animals get their food from eating plants or other animals. | Identify adaptations of prey and predators. | B1.4a | B3.3.2 |
| ELB9b | Know that many different materials cycle through an ecosystem. | | B4.1a | B3.3.6 |
| ELB9c | Explain the importance of the carbon cycle and the water cycle to living organisms. | | B4.1c | B3.3.7 |
| ELB9d | Explain that microorganisms are involved in the cycling of materials through an ecosystem. | | B4.1b | B3.3.5 |
| ELB9e | Understand how some animals are adapted as successful predators. | | B5.2c | B3.4.1 |
| ELB9f | Understand the terms herbivore and carnivore. | Construct a food chain using well-known examples. | B4.1d | B3.3.4 |
| ELB9g | Be able to construct a simple food chain with a plant, a herbivore and a carnivore. | Use simple food webs to predict effects of changes on different members of the food web. | B4.1d | B3.3.4 |
| ELB9h | Be able to interpret a simple food web (limited to 3 organisms at any level). | | B4.1d | B3.3.4 |
| ELB9i | Understand how a change affecting one species in a food web can affect another species in the same food web. | | B4.1e B4.1f | B3.4.1 |
| ELB9j | Be able to describe and carry out simple sampling methods: limited to pooters, nets, pitfall traps and quadrat surveys. | Collect data using a variety of sampling techniques. | B6.1a | B3.4.3c |

| ELB9 Creepy crawlies | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB9k | Be able to use simple keys to name plants and animals. | Collect pond or leaf-litter organisms. Use a key to identify collected organisms. | B6.1a | |
| ELB9l | Describe that DNA is now used to help classify organisms. | | B5.2b | B6.2.1 |
| ELB9m | Know the meaning of the term habitat. | Match plants and animals to their habitats. | | |
| ELB9n | Understand that organisms are adapted to live in their habitat. | | B5.2c | |
| ELB9o | Be able to estimate the number of plants in an area using results of a quadrat survey. | Estimate the number of weeds in a field. | B6.1a | B2.3.3c |
| ELB9p | Describe the impact of humans on biodiversity. | | B6.1b | B6.3.1 |
| ELB9q | Explain some of the reasons why scientists want to maintain biodiversity. | | B6.1c | B6.3.2 |
| Suggested can-do tasks: B3, U1, U3, U4 | | Suggested PAG: B2 | | |

ELB10 Extinction

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|--|--|---|
| ELB10a | Know that fossils provide evidence of living organisms from long ago to include fossil formation. | Look at display/pictures of fossils. Discuss how fossils were formed. | B5.2e | B6.1.7 |
| ELB10b | Know that living things have been changing through evolution. | | B5.2d | B6.1.3 |
| ELB10c | Understand the term <i>species</i> . | | | |
| ELB10d | Know that some species have changed very little over thousands of years e.g. crocodiles. | | B5.2d | B6.1.3 |
| ELB10e | Be able to identify variations in animals or plants of the same species [no recall expected]. | Spot variation in animals and plants of the same species (photographs/living things). | B5.2a | B6.1.1 |
| ELB10f | Know that all variations in a species arise from mutations. | Discuss that a mutation is a very small change in the DNA. | B5.1d | B6.1.2 |
| ELB10g | Understand that living things compete for shelter, food and mates, in order to survive. | | B4.1f | B3.3.5 B6.1.4 |
| ELB10h | Know that the better adapted individuals will survive and can breed and pass on their features to the next generation. | | B5.2c | B6.1.4 |
| ELB10i | Understand the term <i>habitat</i> . | | | |
| ELB10j | Understand that a species may become extinct if their habitat changes or another species is better adapted to survive there. | Match species to the reasons for them becoming endangered /extinct. Match species to the reasons for them becoming endangered /extinct. | B5.2d | B6.1.4 |
| ELB10k | Understand how human beings have caused some species to become endangered or extinct: habitat destruction, hunting, pollution. | Use the internet to find names of some animals/plants that are endangered species. Produce a poster on how to protect a chosen species. | B6.1.b | B3.3.5 |

ELB11 My genes

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|---|--|---|
| ELB11a | Know that human cells contain a nucleus. | Make models, use books, use the internet or multi-media to show that the nucleus contains chromosomes. | B1.1.b | B1.1.1a |
| ELB11b | Know that the nucleus contains chromosomes which can be seen with a light microscope during cell division but can be seen in greater detail with an electron microscope. | Look at chromosomes using a root tip squash in allium or lily. Show an electron micrograph of DNA/ chromosome. | B1.1c | B1.1.1a |
| ELB11c | Know that chromosomes are made of DNA. | | | |
| ELB11d | Describe DNA as two strands forming a double helix. | Use pipe cleaners or coloured sweets to make models of DNA. | B1.2a B1.2b | B1.1.3 |
| ELB11e | Know that lengths of DNA in chromosomes are genes. | | B1.2b | B1.1.5 |
| ELB11f | Know that our DNA carries our unique genetic code. | | B5.1b | B1.1.2 |
| ELB11g | Describe the genome as the entire genetic material of an organism. | | B5.1b | B1.1.2 |
| ELB11h | Know that most human features are determined by a person's genes. | Record and present data on variation in human features. | B5.1c | B1.1.4 |
| ELB11i | Be able to classify a range of human features as genetic: e.g. tongue rolling, ear lobes, environmental e.g. scars, accent, and both e.g. hair colour, good at sport. | Look at photographs of families and identify similar features. | B5.2a | B6.1.1 |
| ELB11j | Understand that environment also affects many features. | Discuss if scars are passed from parent to offspring. | B5.1c | B1.1.4 |

| ELB11 My genes | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB11k | Understand that most features are affected by several genes, e.g. height. | | B5.1j | B1.3.1 |
| ELB11l | Interpret data on human variation. | | | B6.1.1 |
| ELB11m | Know that some genes are dominant and some are recessive. | Discuss that a person gets two genes for each feature – one from their mum and one from their dad. One may be dominant one is recessive. | B5.1a | B1.2.1 |
| ELB11n | Know how to use simple Punnett squares to show inheritance of genotype ratios. | Use the resource Sexual reproduction – Kittens and variation: http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-biology-a-j247-from-2016/ Use simple Punnett squares to show possible genotypes and the ratio of each. | B5.1g B5.1h | B1.2.2 B1.2.3 |
| ELB11o | Know that some diseases are caused by ‘faulty genes’. | Watch video material describing genetic diseases. | B6.3r | B1.3.1 |
| ELB11p | Know that embryos can be tested for certain genes. | Discuss the ‘23 and me’ test. | B6.3r | B1.3.1 |
| ELB11q | Understand that people have different viewpoints about such testing. | Discuss viewpoints people may have about testing embryos for certain genes. | B6.3r | B1.3.1 |
| Suggested can-do tasks: B1, B4, U1, U3, U4 | | Suggested PAG: B1 | | |

ELB12 Food factory

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|--|--|---|
| ELB12a | Know that plants make their own food from carbon dioxide in the air and water. | | B1.4b | B3.1.1 |
| ELB12b | Know that this process is called photosynthesis. | | B1.4b | B3.1.1 |
| ELB12c | Know that plants also need light to make their own food. | | B1.4b | |
| ELB12d | Explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis. | Investigate the factors that can affect the rate of photosynthesis on <i>Cabomba</i> . | B1.4e | B3.1.4 |
| ELB12e | Know that plants make sugars and some is stored as starch. | Test a leaf for starch. | B1.4c | B3.3.2 |
| ELB12f | Know that oxygen is a waste product of photosynthesis. | Discuss that photosynthesis is the reverse equation to respiration. | B1.4b | B3.1.1 |
| ELB12g | Explain how the structure of xylem and phloem are adapted to their functions in the plant. | Look at the 'strings' of banana to look for xylem. | B2.2j | B3.2.5a |
| ELB12h | Explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function. | Compare grass grown with and without fertiliser. | B2.2f | B3.2.4 |
| ELB12i | Describe the processes of transpiration and translocation, including the structure and function of the stomata. | | B2.2g | B3.2.6 |
| ELB12j | Explain the effect of a variety of environmental factors on the rate of water uptake by a plant, to include light intensity, air movement and temperature. | Investigate the effect of changes in light intensity, air movement and temperature on transpiration. | B2.2i | B3.2.7 |

| ELB12 Food factory | | | | |
|---|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELB12k | Know that most of the milk we buy comes from cows (or sheep or goats) and is processed before being supplied to customers. | Compare the taste of different types of milk. Test samples of milk to see how fresh it is. Make cheese or yoghurt. Carry out a consumer preference test on varieties of cheese and yoghurt. | | |
| ELB12l | Explain the impact of the selective breeding of food plants and domesticated animals to include milk yield in cattle. | | B6.2a | B6.1.6 |
| ELB12m | Describe genetic engineering as a process which involves modifying the genome of an organism to introduce desirable characteristics. | | B6.2b | B1.3.2 |
| ELB12n | Explain some of the possible benefits and risks, including practical and ethical considerations, of using gene technology and cloning in modern agriculture and medicine. | Know that cuttings, runners and tubers are examples of cloning. Know that cloning produces identical offspring. Grow plants from cuttings, and/or compare cuttings grown with or without rooting powder. Discuss the advantages and disadvantages to garden centres of cloning plants. | B6.3a | B1.3.4 |
| Suggested can-do tasks: B1, B2, B4, U1, U2, U3, U4 | | Suggested PAG: B4 | | |

| ELC1 Physical or chemical change | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC1a | Explain states of matter using the particle model. | Demonstrate the particle model using a suitable example – e.g. using the students as the particles or using balls. | | C1.1.1 |
| ELC1b | Explain changes of state using the particle model. | Investigate how rain is made using a suitable experiment: https://www.youtube.com/watch?v=9kRkQ9tyq3U | C1.1.b | C1.1.1 |
| ELC1c | Describe the physical states of products and reactants using state symbols: (s), (l), (g) and (aq). | | C3.1f | C2.4.4 |
| ELC1d | Plan an experiment to work out the melting point of a solid. | Investigate the melting and boiling point of water and plot the results. | C2.1b | |
| ELC1e | Use data to predict states of substances under given conditions. | Discuss if water is a solid, liquid or gas at different stated temperatures. | C2.3e | C1.1.4 |
| ELC1f | Explain chemical reactions using the particle model. | Investigate a suitable chemical reaction. Discuss what makes a successful collision. | C1.1.b | C1.1.1 |
| ELC1g | Use ideas about the behaviour of particles and bonds to explain what happens during of state. | Discuss what happens to water molecules and the bonds between hydrogen and oxygen during a change of state. | C2.3d | C1.1.1 |
| ELC1h | Know that during a change of state the mass of the substance remains the same. | Weigh the mass of ice and water after melting. | C3.1k | C5.2.1 |
| ELC1i | Explain using the particle model why in a non-enclosed reaction there may be loss of mass during a chemical reaction limited to one of the products being a gas. | | C3.1l | C5.2.2 |
| ELC1j | Know that some reactions may be reversed e.g. forward reaction: $a+b \rightarrow c+d$ and backwards: $c+d \rightarrow a+b$. | Investigate a reversible reaction. | C5.2a | C6.3.1 |
| Suggested can-do tasks: C1, U1, U2, U3, U4 | | Suggested PAG: C5 | | |

| ELC2 Acids and alkalis | | | | |
|----------------------------|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC2a | Be able to label simple laboratory apparatus used to obtain a dye from a plant (limited to beaker, stirring rod, heating apparatus, filter funnel, filter paper and mortar and pestle). | Find/select and name the apparatus needed to obtain a dye from a plant. Extract plant dyes from flowers, beetroot or red cabbage and use the solution to identify acids and alkalis. | | |
| ELC2b | Know that the colour of some dyes can be changed by adding acids and alkalis. | Investigate how the colour of dyes changes when acids or alkalis are added. | | |
| ELC2c | Understand safety precautions when using acids or alkalis. | | | |
| ELC2d | Interpret simple information about the use of indicators to classify solutions as acid, neutral or alkali. | Use other indicators such as litmus to identify solutions that are acidic, alkaline or neutral. Use universal indicator to measure the pH of common substances. | C3.3h | C6.1.4 |
| ELC2e | Know how to use the pH scale. | Use Universal Indicator to measure the pH of common substances. Create a 'rainbow' of colours using Universal Indicator. | C3.3h | C6.1.4 |

| ELC2 Acids and alkalis | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC2f | Know that pH can be measured electronically. | | | |
| ELC2g | Know that neutralisation occurs when acids and alkalis are mixed. | | C3.3d | C5.3.3 |
| ELC2h | Know that acids produce protons (H ⁺) and alkalis produce hydroxide ions (OH ⁻). | Find the names and uses of common acids and alkalis. | C3.3e | C5.3.4 |
| ELC2i | Know that when you mix acids and alkalis together the protons (H ⁺) and hydroxide ions (OH ⁻) form H ₂ O this is called neutralisation (introduce the name ions to higher level learners, lower level learners may just refer to 'H' and 'OH'). | Investigate the change in pH when acid and alkali are mixed. | C3.3e | C5.3.5 |
| ELC2j | Understand the uses of neutralisation, limited to curing indigestion and reducing the acidity of soils. | | C3.3d | C5.3.3 |
| ELC2k | Know that excess acid in the stomach is a cause of indigestion. | Find out about the contents of different types of indigestion remedies. | C3.3d | C5.3.3 |
| ELC2l | Interpret simple information comparing the effectiveness of different indigestion remedies [no recall expected]. | Compare different indigestion remedies by finding out how much acid they neutralise. | C3.3d | C5.3.3 |
| Suggested can-do tasks: C1, C3, U1, U2, U3, U4 | | | | |

ELC3 Everything in its place

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELC3a | Know the relative size of atoms and small molecules. | | C1.2c | C2.1.5 |
| ELC3b | Know that scientists' ideas of what an atom looks like (called the atomic model) has changed over time. | Use the superheroes of the atomic model activity (http://www.ocr.org.uk/qualifications/gcse-gateway-science-suite-chemistry-a-j248-from-2016/). | C1.2a | C2.1.1 |
| ELC3c | Describe the atom as a nucleus surrounded by particles called electrons. | Build a model of an atom. | C1.2b | C2.1.2 |
| ELC3d | Recall relative charges and approximate relative masses of protons, neutrons and electrons. | Fill in a table of sub-atomic particles. | C1.2d | C2.1.3 |
| ELC3e | Explain how the position of an element in the Periodic Table is related to its atomic number (the number of protons in the nucleus). Use the names and symbols of common elements from the Periodic Table. | | C2.2c | C2.2.1 |
| ELC3f | Use the names and symbols of the first 20 elements from the Periodic Table. | | C3.1c | C2.4.3 |
| ELC3g | Use the names and symbols of the first Groups 1, 7 and 0 elements from the Periodic Table. | Colour in a Periodic Table using different colours for the different groups. | | |
| ELC3h | Recall the names of the periodic Groups [1 (alkali metals), 7 (halogens) and 0 (noble gases)]. | Label the Periodic table appropriately. | C4.1a | C2.4.3 |
| ELC3i | Know that the elements in Groups 1, 7 and 0 are clustered together because they all have the same number of electrons in the outer shell (Group 1 has one electron, Group 7 has seven and Group 0 has eight electrons). | | C4.1a | C2.4.3 |

ELC3 Everything in its place

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELC3j | Recognise that the atomic structure of metals and non-metals relates to their position in the Periodic Table. | Draw a line on the Periodic Table to separate the metals from the non-metals. Compare the simple properties of metals and non-metals. | C2.2b | C2.3.4 |
| ELC3k | Explain that isotopes are different forms of the same atom with a different number of neutrons. | | C2.2e | C2.2.2 |
| ELC3l | Calculate numbers of protons, neutrons and electrons in atoms given their atomic number and mass (higher level learners can also do this exercise with isotopes). | | C1.2e | C2.1.7 |

Suggested can-do task: U1

ELC4 Clean air and water

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELC4a | Know that the Earth is surrounded by a mixture of gases called the atmosphere. | Compare charts showing the composition of polluted and unpolluted air. | C6.2a | C1.1.5 |
| ELC4b | Know how the atmosphere was formed and has changed over time. | | C6.2a | |
| ELC4c | Know that the atmosphere now contains about 80% nitrogen and 20% oxygen. | Watch a demonstration to show that not all of the air is reactive. | C6.2b | C1.1.6 |
| ELC4d | Know that there are smaller amounts of water vapour, carbon dioxide and other gases in the air. | Draw pie charts to show the composition of the atmosphere. | | |
| ELC4e | Know that fuels contain carbon, which forms carbon dioxide when the fuel burns. | Demonstrate that carbon dioxide and water form when fuels burn. | C6.2d | C1.3.3. |
| ELC4f | Know how to test for the presence of carbon dioxide. | Bubble the gas produced through limewater. | C3.1g | C1.1.13 |
| ELC4g | Know that the amount of carbon dioxide in the atmosphere is slowly increasing. | Look at/plot a graph of global CO ₂ levels against time (years). | C6.2d | C1.3.2 |
| ELC4h | Know that the increasing level of carbon dioxide is linked to global warming. | Design a poster describing the main causes of global warming. | C6.2c | C1.3.1 |
| ELC4i | Know that burning fuels may add harmful chemicals into the atmosphere. | Watch or read news reports about a way of reducing pollution from burning fuels. | C6.2d | C1.3.2 |
| ELC4j | Know that these harmful chemicals are called pollutants. | Look at maps showing levels of nitrogen oxides across a region. | C6.2f | C1.1.7 |
| ELC4k | Understand some of the problems these pollutants cause. | Research and present information on air pollution and health. Survey the number of asthma sufferers (class/ form/ school/ family). | C6.2f | C1.1.8 |

| ELC4 Clean air and water | | | | |
|----------------------------|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC4l | Know that carbon monoxide forms when fuels from crude oil burn in a limited supply of air. | Look at advice to the public about carbon monoxide poisoning and how to avoid the accidents that it can cause. Examine a carbon monoxide detector and the instructions for its use. | C6.2f | C1.1.7 |
| ELC4m | Know that fossil fuels contain small amounts of sulfur which are released as sulfur dioxide when the fuel is burnt. | Demonstrate (in a fume cupboard) burning sulfur in a gas jar, adding water and testing the pH to show SO ₂ dissolves to form an acidic solution. | C6.2f | C1.1.7 |
| ELC4n | Know that sulfur dioxide is a cause of acid rain. | Produce a poster on acid rain. | C6.2f | C1.1.7 |
| ELC4o | Know that nitrogen and oxygen from the air can make nitrogen oxides in a car engine. | | C6.2f | C1.1.7 |
| ELC4p | Know that a catalytic converter gets rid of pollutants like nitrogen oxides. | | C6.2f | C1.1.7 |
| ELC4q | Interpret simple data on the removal of pollutants from car exhausts. | Research ways in which atmospheric pollution from motor vehicles can be reduced, e.g. use more efficient engines, use low sulfur fuels, use catalytic converters, and have laws and tests on cars. | C6.2f | C1.1.7 |
| ELC4r | Be able to state the benefits and drawbacks of using catalytic converters. | | C6.2f | C1.1.7 |
| ELC4s | Know that exhaust gas emissions are part of an MOT vehicle test. | Look at the results from an MOT test on a car and work out why it has failed the test. | C6.2f | C1.1.7 |

Suggested can-do tasks: C1, C3, U1, U2, U3, U4

ELC5 Novel materials

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|--|--|---|
| ELC5a | Know that carbon can form four bonds (covalent). | Construct simple organic compounds using chemical model kits. | C2.3a | C4.2.2 |
| ELC5b | Know that carbon can form many compounds because it can arrange itself into a variety of shapes limited to chains and rings. | Look at the variety of bonds carbon can form. Demonstrate models of diamond and graphite. | C2.3b | C4.2.3 |
| ELC5c | Explain the properties of diamond, graphite, fullerenes and graphene in terms of their structures and bonding. | Demonstrate the structure of graphene. | C2.3c | C4.2.6 C4.3.4 |
| ELC5d | Using graphite and diamond explain that their different properties are related to the arrangements of bonds they contain. | Demonstrate the hardness of diamond with a diamond drill/cutting disk <i>versus</i> a pencil. Link hardness of minerals to Mohs' scale. | C2.3c | C4.2.6 |
| ELC5e | Interpret simple data comparing the properties of different materials [no recall expected]. | Compare tennis rackets made from carbon fibre, metals and wood frames. Study data on different materials and make predictions about the suitability of particular materials for different uses. Produce a display about materials used for sports. | C6.1d | C4.1.2 |
| ELC5f | Know that a composite material contains at least two different materials. | Demonstrate the advantages of composite materials by showing the properties jelly <i>versus</i> jelly containing spiral pasta. | C2.1e C6.1e | C4.1.1 C5.1.1 |
| ELC5g | Know that an alloy is a mixture of two or more elements, at least one of which is a metal. | Produce a poster to show uses of alloys/what elements are in different alloys. | C2.1e C6.1e | C4.1.1 C5.1.1 |

ELC5 Novel materials

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|---|--|---|
| ELC5h | Know the names and one use of the alloys: steel, solder, aluminium alloy and brass. | Demonstrate making an alloy of solder (in fume cupboard) by melting 60% lead and 40% tin. | C2.1e C6.1e | C4.1.1 C5.1.1 |
| ELC5i | Know that the properties of alloys are different from the properties of the metals from which they are made. | Compare the ease of melting solder and pure lead or pure tin. | C2.1e C6.1e | C4.1.1 C5.1.1 |
| ELC5j | Interpret information linking the properties of materials to their uses [no recall expected]. | Discuss the use of alloys in everyday life, e.g. bike frames, coins and window frames. | C6.1e | C4.1.2 |
| ELC5k | Understand the term ' <i>smart</i> ' alloy. | Investigate/demonstrate nitinol – a smart alloy. | C2.1e C6.1d | C4.1.1 C4.1.2 C5.1.1 |

Suggested can-do tasks: C1, C3, U1, U2, U3, U4

| ELC6 Sorting out | | | | |
|----------------------------|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC6a | Explain what is meant by the purity of a substance, distinguishing between the scientific and everyday use of the term <i>'pure'</i> . | Get students to define what pure means and compare this to the dictionary definition of the word. Investigate the freezing and boiling point of pure water, and how impurities such as salt affect this. | C2.1a | C5.1.2 |
| ELC6b | Know that a mixture contains two or more uncombined substances. | | C2.1e | C5.1.1 |
| ELC6c | Know that mixtures contain substances that can be separated from each other. | Watch a presentation about the separation techniques used in hospitals: – dialysis uses thin membrane to separate the waste in blood. – centrifuging used to separate a suspended solid from a liquid. | | |
| ELC6d | Suggest suitable separation techniques given information about the substances. | Choose how to separate a mixture (by dissolving and filtering), e.g. salt and sand. | C2.1j | C5.1.8 |
| ELC6e | Be able to plan how to obtain a soluble substance (e.g. salt, copper sulfate or sugar) from an aqueous solution by crystallisation. | Make crystals from a salt solution. | C2.1f | C5.1.7 |
| ELC6f | Be able to plan how to separate an insoluble substance from water by filtration e.g. sand. | Discuss how filtering works. Investigate the best paper for tea bags or coffee filters. Look at various ways to separate mixtures in everyday life e.g. sieves, vacuum cleaner filters, car air-intake filters. | C2.1f | C5.1.7 |

| ELC6 Sorting out | | | | |
|---|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC6g | Know how chromatography is used to separate mixtures into their constituents. | Use chromatography to solve a simple forensic problem or to investigate food colours. | C2.1h | C5.1.4 |
| ELC6h | Interpret simple chromatograms. | Use and make chromatograms. | C2.1i | C5.1.5 |
| ELC6i | Suggest how chromatography can be used to test pure from impure substances. | | C2.1k | C5.1.6 |
| ELC6j | Following a chromatography experiment measure the distance moved by the solvent and the spots. | | C2.1i | C5.1.5 |
| ELC6k | Calculate the R_f value from the spots by dividing the distance moved by the spot by the distance moved by the solvent. | | C2.1i | C5.1.5 |
| ELC6l | Understand that distillation is used to separate liquids with different boiling points. | Investigate the freezing and boiling point of pure water, and how impurities such as salt affect this. | C2.1f | C5.1.7 |
| ELC6m | Know that distillation is used to produce some alcoholic drinks, e.g. whisky. | Watch a video about the use of distillation in industry. | C2.1f | C5.1.7 |
| ELC6n | Use melting point data to distinguish pure from impure substances. | Investigate the melting point of salol and compare the experimental results with the pure melting point. | C2.1b | C5.1.3 |
| ELC6o | Know how drinking water is purified. | Distil pure water from salt water. | C6.2g | C1.4.1 |
| Suggested can-do tasks: C1, C2, C3, U1, U2, U3, U4 | | Suggested PAGs: C2, C3, C4 | | |

ELC7 Let's get together

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELC7a | Using sodium and chlorine show how atoms can donate electrons. | For more advanced students show how atoms can donate electrons using magnesium and oxygen. | C2.2g | C2.3.6 |
| ELC7b | Know that when sodium loses an electron it becomes positive and when chlorine gains an electron it becomes negative and that these charges hold the two together as salt (sodium chloride). | For more advanced students discuss that when magnesium loses two electrons it becomes 2+ and when chlorine gains two electrons it becomes 2– and that these charges hold the two together as salt (magnesium chloride). | C2.2g | C2.3.5 |
| ELC7c | Construct dot-and-cross diagrams for sodium chloride [outer shell only]. | | C2.2h | C2.3.8 |
| ELC7d | Know that after reacting the mass of salt produced should be the same as the mass of sodium and chlorine gas. | Demonstrate the reaction of sodium and chlorine (http://www.rsc.org/learn-chemistry/resource/res00000732/heating-group-1-metals-in-air-and-in-chlorine?cmpid=cmp00005145). | C3.1k | C5.2.1 |
| ELC7e | Calculate masses of the product of a simple chemical reaction when given the reactants in a balanced chemical equation. | | C2.1c | C5.2.3 |
| ELC7f | Recognise representations of atomic models limited to dot-and-cross diagrams, ball and stick models and two- and three-dimensional representations. | | C2.2i | C2.3.5 |
| ELC7g | Use chemical symbols to write the formulae of elements and simple compounds limited to sodium chloride, magnesium oxide, sodium hydroxide, hydrochloric acid, hydrogen and carbon dioxide. | | C3.1a | C2.4.1 |

| ELC7 Let's get together | | | | |
|----------------------------|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC7h | Use the formulae of two common ions to deduce the formula of a compound limited to similar charged ions e.g. +/- or 2+/2- etc. | | C3.1a | C2.4.1 |
| ELC7i | From a model or a diagram to work out the proportion of sodium and chlorine atoms in a molecule of sodium chloride. | Use sweets and pasta to create a model of a sodium chloride lattice. | C2.1d | C3.4.6 |
| ELC7j | Use the names and symbols of the first 20 elements from the Periodic Table to write the product names of some chemical reactions limited to chloride, fluoride and oxide. | For more advanced students use the names and symbols of the first 20 elements from the Periodic Table to write chemical formulae. | C3.1c | C2.4.6 |
| ELC7k | Describe how to get the sodium and chlorine back by electrolysis with the positive sodium being attracted to the negative electrode and the negative chloride being attracted to the positive electrode. | Carry out the electrolysis of aqueous sodium chloride. Discuss that to get sodium metal and chlorine gas molten sodium chloride would have to be used. Discuss why this is not done in a class. | C3.4d | C3.3.1 |
| ELC7l | Know that sodium metal is formed at the negative electrode (cathode) and the chlorine/non-metal formed at the positive electrode (anode) using inert electrodes. | | C3.4a | C3.3.3 |

ELC7 Let's get together

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|---|--|--------------------------------------|--|---|
| ELC7m | Know that after electrolysis the theoretical mass of sodium and chlorine gas produced should be the same as the starting mass of salt. | | C3.1k | C5.2.1 |
| ELC7n | Know that at the cathode electrons are added to the positively charged sodium to remake sodium metal. | | C3.4c | C3.3.3 |
| ELC7o | Predict which electrode magnesium metal will be made during the electrolysis of magnesium chloride. | | C3.4d | C3.3.3 |
| ELC7p | Know the names of other chemical bonds limited to covalent and metallic bonds. | | C2.2f | C2.3.6 C3.1.1 |
| Suggested can-do tasks: C1, C2, C3, C4, U1, U2, U3, U4 | | Suggested PAG: C1 | | |

ELC8 Heavy metal

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|--|--|---|
| ELC8a | Describe the properties of metals on the basis of their characteristic physical and chemical properties. | | C2.2a | C2.2.4 |
| ELC8b | Position carbon in the reactivity series of metals. | | | C2.2.4 |
| ELC8c | Know how some metals (e.g. iron and copper) can be extracted by heating its ore with carbon. | Extract copper by heating malachite and carbon. Research some uses of copper. | C6.1a | C3.2.4 |
| ELC8d | Know that rusting needs iron, water and oxygen. | Investigate the corrosion of aluminium and iron using different conditions e.g. salt water, acid rain and moist air. | C6.1e | C4.4.3 |
| ELC8e | Explain reduction and oxidation in terms of loss or gain of oxygen, identifying if iron is being reduced or oxidised when rusting. | | C3.3a | C4.4.1 |
| ELC8f | Know that paints are used to decorate or protect surfaces. | Find out about corrosion prevention on large structures such as the Eiffel Tower or Forth Road Bridge. | C6.1d | C4.4.3 |
| ELC8g | Know that salt water speeds up rusting. | | C6.1e | C4.4.4 |
| ELC8h | Be able to describe similarities and differences between the properties of iron and aluminium, limited to: iron is more dense than aluminium; iron is magnetic; aluminium is not; iron corrodes (rusts) easily and aluminium does not. | Research uses of aluminium and iron. Compare the physical properties of iron and aluminium by data search and/or by experiment. | C6.1d | C4.4.3 |
| ELC8i | Know that electrolysis is used to extract some metals (e.g. aluminium) from their ores because they are more reactive than carbon. | | C6.1b | C3.2.5 |

| ELC8 Heavy metal | | | | |
|---|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC8j | Know that the aluminium is formed at the cathode non-metals are formed at the anode in electrolysis using inert electrodes. | | C3.4a | C3.3.3 |
| ELC8k | Recall one advantage and one disadvantage of making cars from aluminium. | | C6.1e | C4.4.3 |
| ELC8l | Interpret simple information about metals used to make cars [no recall expected]. | Discuss the advantages and disadvantages of aluminium cars e.g. Land Rovers. | C6.1d | C4.4.4 |
| ELC8m | Understand why metals are worth recycling (metals are a finite resource and recycling metal is cheaper than making it from the ore and that it saves resources and energy). | Find data about the amounts of metal ores remaining in the Earth's crust. Discuss why recycling is cheaper than mining it (e.g. no mining costs, less processing and transport, less energy to make a product). | C6.1f | C4.4.5 |
| ELC8n | Interpret information on the recycling of materials [no recall expected]. | Research how much your local council recycles. | C6.1g | C4.4.6 |
| Suggested can-do tasks: C1, C2, U1, U2, U3, U4 | | Suggested PAG: C5 | | |

| ELC9 Fuels | | | | |
|----------------------------|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC9a | Know that crude oil is a toxic, dark, sticky liquid. | Show a sample of crude oil. | C6.1k | C3.4.3 |
| ELC9b | Know that crude oil is made mainly of hydrocarbons in chains of varying length. | Make polymer chains using monomer paper clips or chemical model kits. | C6.1j | C3.4.4 |
| ELC9c | Know that hydrocarbons are composed of hydrogen and carbon. | Demonstrate model hydrocarbons. | C6.1j | C3.4.4 |
| ELC9d | Recognise that the formula of hydrocarbons will contain carbons, hydrogens and numbers. | Using a model hydrocarbon demonstrate how the chemical formula of hydrocarbons is derived. | C3.1a C6.1j | C2.4.3 C3.4.4 |
| ELC9e | Know that you can calculate the number of hydrogens on a simple hydrocarbon by counting the carbons, multiplying this number by 2 and adding two to the answer. | You may wish to introduce C_nH_{2n+2} . | C6.1j | C3.4.4 |
| ELC9f | Know that modern life is crucially dependent upon hydrocarbons from crude oil and recognise that crude oil is a finite resource. | Research the reserves of gas and oil. | C6.1l | C3.4.1 C3.4.2 |
| ELC9g | Know that crude oil is a good source of hydrocarbons that are used to make many products we enjoy and rely on. | Investigate the use of hydrocarbons in products. | C6.1k | C3.4.2 |
| ELC9h | Know that crude oil can be separated into more useful parts at an oil refinery. | Watch a demonstration of distillation of artificial crude oil in the laboratory. | C6.1h | C3.4.3 |

| ELC9 Fuels | | | | |
|----------------------------|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC9i | Know that in an oil refinery crude oil is separated into fractions based on the boiling point of the hydrocarbon. | Make a virtual visit to an oil refinery on the internet or watch a video about refining. | C2.1f | C3.4.3 |
| ELC9j | Know that petroleum gases, petrol, kerosene and diesel are all hydrocarbons that come from crude oil. | Make models of hydrocarbon chains of various lengths. | | |
| ELC9k | Know the uses of these fuels: petroleum gases, such as propane, in portable gas cylinders; petrol in cars; kerosene in airplanes; diesel in lorries, buses, trains and cars. | Construct a presentation or display matching each of the fractions to their uses. | C6.1.j | C3.4.3 |
| ELC9l | Understand that some fuels ignite more easily than others do and that this is important for their uses. | Watch a demonstration that some fuels catch fire more easily than others. | C6.1e | C1.2.3 |
| ELC9m | Know that burning fuels produces energy for heating, transport and making electricity in power stations. | Compare the advantages of different fuels – solids, liquids and gases. | C3.2a | C1.2.1 |
| ELC9n | Be able to label the apparatus used to find out how much energy a flame gives out. | Burn a fuel and use the energy to heat water. | C3.2a | C4.4.3 |
| ELC9o | Interpret data to decide which fuel gives out most energy when the same amount burns. | Compare the energy values of various fuels. | C6.1e | C4.4.4 |
| ELC9p | Give one advantage and one disadvantage of petrol and diesel for transport. | Watch or read a news report about a way of reducing pollution from burning fuels. | C6.1e | C4.4.4 |
| ELC9q | Interpret simple information about the use of different fuels [no recall expected]. | Compare information for customers about diesel cars and petrol cars e.g. fuel consumption, 0–60 mph time, pollution and cost. | C6.1e | C4.4.4 |

| ELC9 Fuels | | | | |
|----------------------------|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC9r | Understand that people can make choices about which fuels to use. | | C6.1e | C4.4.4 |
| ELC9s | Know that hydrocarbons can be made into smaller molecules by a process called cracking and that the products of cracking can be used to make plastics. | Demonstrate cracking. | C6.1m | C3.4.15 |
| ELC9t | Know that plastics are made from these small molecules called monomers. | | C6.1m | C3.4.15 |
| ELC9u | Know that lots of monomers join together to form a long chain polymer. | Demonstrate the manufacture of nylon (http://www.rsc.org/learn-chemistry/resource/res00000755/making-nylon-the-nylon-rope-trick?cmpid=cmp00000834). | C6.1m | C3.4.15 |

Suggested can-do tasks: C1, C3, U1, U2, U3, U4

ELC10 Are you overreacting?

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELC10a | Know that the rates of chemical reactions can vary greatly. | | | |
| ELC10b | Interpret simple visual images showing different rates of chemical reactions. | Demonstrate the iodine clock reaction https://www.youtube.com/watch?v=KWJpKNQfXWo http://www.rsc.org/learn-chemistry/resource/res00000744/iodine-clock-reaction?cmpid=CMP00005152 . | | |
| ELC10c | Know that a reaction stops when one of the reacting substances is used up. | | | |
| ELC10d | Know that a reaction can go forwards or backwards and that a reaction may finish when the rate of the forward reaction may equal the rate of backward reaction. | | C5.2b | C6.3.2 |
| ELC10e | Deduce an order of reactivity of alkali metals based on their reaction with water. | Demonstrate the reaction of Group 1 metals with water. | C4.1e | C3.2.1 |
| ELC10f | Know that the reactivity of metals with water or dilute acids is related to the tendency of the metal to form its positive charge the easier the positive charge is formed the more reactive it is. | Investigate the reactivity of metals in dilute acids. | C4.1c | C3.2.2 |
| ELC10g | Predict possible reactions and probable reactivity of elements from their positions in the Periodic Table limited to Group 1, 7 and 0. | Research into noble gases and their uses. | C4.1c | C2.2.7 |

| ELC10 Are you overreacting? | | | | |
|---|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC10h | Know that magnesium, zinc and iron react with acids to make hydrogen gas. | Investigate the gas produced by the reaction of metals with dilute acids. | C4.1d | C3.2.2 |
| ELC10i | Know the test for hydrogen. | Test the gas produced by the reaction of metals with dilute acids. | C3.1g | C1.1.13 |
| ELC10j | Deduce an order of reactivity of magnesium, zinc and iron based on their reaction with acid. | From experimental data produce a reactivity series of metals. | C4.1d | C3.2.1 |
| Suggested can-do tasks: C1, C3, U1, U2, U3, U4 | | Suggested PAG: C5 | | |

ELC11 How fast? How slow?

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELC11a | Know ways of monitoring the progress of a reaction. | <p>Watch video clips of fires (including chip pan fires), rusting and explosions to illustrate different rates of chemical reactions.</p> <p>Look at the application of rate of reaction in everyday life (e.g. speed of cooking with a pressure cooker, slowing up rusting, rate of dissolving tablets for medicinal use).</p> <p>Video clip (or demonstration) of flour/<i>lycopodium</i> explosions.</p> | C5.1a | C6.2.7 |
| ELC11b | Interpret information from charts and graphs about rates of reaction. | Investigate the effect of temperature on the speed of dissolving indigestion tablets. | C5.1b | C6.2.8 |
| ELC11c | Understand how particle collisions can be used to explain reaction rates. | | C5.1d | C6.2.2 |
| ELC11d | Know that increasing temperature usually speeds up chemical reactions. | <p>Investigate the effect of making tea using ice water, room temperature and boiling water.</p> <p>Investigate the effect of temperature when baking powder is added to vinegar.</p> | C5.1c | C6.2.1 |
| ELC11e | Know that lowering the temperature (in a refrigerator or freezer) slows down the changes that make food go bad. | Investigate how long a food takes to lose quality at room temperature, in the fridge and in the freezer. | C5.1c | C6.2.1 |
| ELC11f | Know that increasing the concentration increases the speed of a chemical reaction. | Investigate the effect of concentration on reaction time, e.g. magnesium ribbon and hydrochloric acid, resin and hardener in car body filler. | C5.1c | C6.2.1 |

ELC11 How fast? How slow?

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELC11g | Be able to label simple laboratory apparatus used to find out about rates of reaction, limited to: beaker, flask, measuring cylinder, thermometer, stirring rod, test tube, gas syringe, top pan balance, stop clock/digital watch. | | C5.1a | C6.2.7 |
| ELC11h | Know that the rate of reaction is increased when several small lumps of solid are used rather than a few large lumps. | Investigate the effect of particle size on reaction time, e.g. marble and hydrochloric acid. | C5.1c | C6.2.1 |
| ELC11i | Understand that a difference in the rate of reaction can be explained by a difference in the surface area. | | C5.1c | C6.2.1 |
| ELC11j | Know that catalysts can alter the rate of a reaction but are not used up in the reaction. | Investigate the effect of metal oxides as catalysts on a solution of hydrogen peroxide and washing up liquid. | C5.1f | C6.2.4 |
| ELC11k | Explain that to get a reaction to start often energy has to be supplied e.g. heat by a Bunsen burner. | Demonstrate the thermite reaction using a magnesium fuse. | C5.1h | C6.2.6 |
| ELC11l | State that activation energy is the energy that needs to be added to start a chemical reaction. | | C3.2c | C6.2.6 |
| ELC11m | Label the activation energy on a graph showing the energy profile of a reaction. | Show that catalysts can often get a reaction started without the use of a Bunsen burner by reducing the amount of energy required to start the reaction. | C3.2b | C6.2.5 C6.2.6 |

| ELC11 How fast? How slow? | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC11n | Interpret simple information on the use of different catalysts [no recall expected]. | | C5.1a | C6.2.4 |
| ELC11o | Know that enzymes act as catalysts in biological systems. | Investigate the effectiveness of biological washing powders. | C5.1i | C6.2.13 |
| Suggested can-do tasks: C1, C3, U1, U2, U3, U4 | | Suggested PAG: C5 | | |

ELC12 CSI plus

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|---|--|---|
| ELC12a | Know that anyone present at a crime scene will leave some evidence behind. | Observe evidence at a made up crime scene, then again after it has been tampered with. | | |
| ELC12b | Understand why crime scene investigators wear special clothing to avoid leaving evidence at a crime scene. | Practise collecting evidence without contaminating or mixing it up. | | |
| ELC12c | Know how an investigator collects evidence at a crime scene – in precisely labelled evidence bags. | Discuss the types of evidence that could be left at a crime scene. | | |
| ELC12d | Know fingerprints are left on a surface because oils from the skin are deposited. | Use sealed jars containing iodine crystals to develop prints on filter paper. | | |
| ELC12e | Know how dusting a surface with a special powder can make fingerprints show up. | Dust for prints using fine aluminium powder. | | |
| ELC12f | Know how fingerprints can be removed from a surface. | Investigate the best method to take fingerprints from different surfaces. | | |
| ELC12g | Know how to make a record of a person's fingerprints. | Use ink pads to make a record of fingerprints. | | |
| ELC12h | Understand that innocent people have their fingerprints taken for elimination. | | | |
| ELC12i | Recognise loop, arch and whorl as features of fingerprints. | Research the main ways of classifying fingerprints. Compare fingerprints to recognise simple arches, loops and whorls. | | |
| ELC12j | Know that no two people have identical fingerprints – not even identical twins. | Discuss why the police keep fingerprints from convicted criminals on file, but not from innocent people. | | |

| ELC12 CSI plus | | | | |
|---|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELC12k | Know that blood contains red blood cells, white blood cells, platelets and plasma. | Make a model of blood e.g. pop bottle containing water, dried peas, red lentils. | | |
| ELC12l | Recall that the main blood groups are A, B, AB and O. | Research the different blood groups, and blood transfusions. Discuss why people volunteer to be blood donors, and why some people cannot give blood. | | |
| ELC12m | Know how chromatography can be used to separate colours in ink. | Separate dyes using chromatography e.g. in a made up solution containing different dyes. | | |
| ELC12n | Understand how the results of separating colours can identify a particular ink as being used e.g. to write a forged cheque. | Compare inks from a 'forged' cheque. | | |
| ELC12o | Know that DNA is inherited from parents. | Make a simple model of a DNA double chain using twisted pipe cleaners. | | |
| ELC12p | Know that identical twins have identical DNA but otherwise DNA is unique. | | | |
| ELC12q | Interpret data from a crime scene and decide whether or not it confirms a suspect's presence. | Produce a poster showing evidence from a made up crime scene. | | |
| Suggested can-do tasks: C1, C3, U1, U2, U3, U4 | | Suggested PAG: C3 | | |

ELP1 Getting the message

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELP1a | Describe how sound waves in air are longitudinal waves. | Demonstrate a longitudinal wave with a spring (e.g. a slinky). | P4.1e | P1.3.2 P1.3.4 |
| ELP1b | Explain how the motion of the molecules in a gas is related to its pressure e.g. shouting <i>versus</i> whispering. | Investigate the range of spoken messages in the playground. | P4.2f | P1.3.2 P1.3.4 |
| ELP1c | Know that even when whispering voice can be overheard. | Find out alternative communication methods e.g. historical uses of light or sound for communication e.g. semaphore, asdic and smoke signals. | P4.2f | P1.3.2 P1.3.4 |
| ELP1d | Know that coding a message increases its security. | Send a coded message by hand signals. Send a message by pigpen cipher. | | |
| ELP1e | Understand that light can be used for communication but requires the use of digital code (e.g. Morse code). | Send a Morse code message by turning a lamp on and off. Discuss the 'Some Mother's Do 'Ave 'Em' theme (http://news.bbc.co.uk/1/hi/magazine/7026637.stm). | P4.2g | P1.1.8 |
| ELP1f | Know that digital signals are either on (1) or off (0). | Investigate binary code. | | |
| ELP1g | Know that light travels through space at a speed of 300 000 km/s. | | P4.2f | P1.3.6 |
| ELP1h | Understand how using light allows messages to be transmitted quickly. | | P4.2g | P1.1.3 P1.3.6 |
| ELP1i | Understand how light travels along an optical fibre from one end to the other by reflection. | Discuss the uses of optical fibres for communication. | P4.2g | P1.3.8 |
| ELP1j | Know that optical fibres transmit data very quickly. | Use optical fibres to send messages in code. | P4.2g | P1.1.3 |

| ELP1 Getting the message | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP1k | Know that light is not the only method of transmitting a signal digitally there are other examples which use the electromagnetic spectrum. | Investigate other forms of using the electromagnetic spectrum for communication. | P4.2g | P1.1.9 |
| ELP1l | Know that household remote control devices use infrared radiation. | Examine a remote control device and use an infrared detector to show that infrared is emitted from it. | P4.2g | P1.1.9 |
| ELP1m | Know that wireless communication devices use radio waves. | Compare mobile and fixed phones. | P4.2g | P1.1.9 |
| ELP1n | Understand the advantages of wireless technology for radio, mobile telephones and laptop computers. | Discuss the advantages and disadvantages of wireless links for computers. | P4.2g | P1.1.9 |
| ELP1o | Know that mobile phones use microwave signals. | Find out how the mobile phone system works. Discuss how the everyday life of a student would be different without a mobile phone. | P4.2g | P1.1.9 |
| ELP1p | Know that sound and images can be transmitted digitally. | | P4.2g | P1.1.9 |
| ELP1q | Know that the main reason for switching to digital television and radio is the improved quality of picture and sound. | | | |
| Suggested can-do tasks: P2, P3, U1, U3, U4 | | Suggested PAG: P4 | | |

| ELP2 Full spectrum | | | | |
|----------------------------|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP2a | Know that visible light is part of a group of waves called the electromagnetic spectrum. | Use a mnemonic such as roll out your Guinness boys in vats or rural old yokels guzzle beer in volumes. | P4.2f | P1.3.11 |
| ELP2b | Know that all waves from the electromagnetic spectrum travel at the speed of light. | | P4.2a | P1.1.3 |
| ELP2c | Be able to list the colours of the visible spectrum in order from red to violet. | Make a rainbow using water from a garden hose. | P4.2d | P1.1.1 |
| ELP2d | Know that a rainbow is a naturally occurring example of the visible spectrum. | | P4.2e | P1.1.2 |
| ELP2e | Know that a visible spectrum can be produced when white light passes through a prism. | Investigate what a prism does to white light. | P4.2d | P1.1.2 |
| ELP2f | Know that a laser produces a narrow, intense beam of light. | Research uses for lasers. | P4.2e P4.2g | P1.1.9 |
| ELP2g | Recall uses of lasers limited to: read CDs, light shows, pointers, weapon guidance, cutting tools. | | P4.2g | P1.1.9 |
| ELP2h | Know that warm and hot objects emit infrared radiation. | Use an infrared detector to show there is radiation beyond red. | P4.2g | P1.1.9 |
| ELP2i | Know that passive infrared sensors and thermal imaging cameras work by detecting body heat. | Look at examples of photographs taken at night, e.g. from surveillance cameras. | P4.2g | P1.1.9 |
| ELP2j | Know that infrared is useful for: remote control for TV etc.; short distance data links for computer or mobile phone; night photography; burglar alarms; heating things, e.g. electric fire, toaster, grill. | Identify household objects which work by using infrared radiation. | P4.2g | P1.1.9 |

| ELP2 Full spectrum | | | | |
|---|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP2k | Recall two examples of uses of microwave radiation from: cooking; mobile phones; radar; communication with satellites. | | P4.2g | P1.1.9 |
| ELP2l | Know that microwaves cause heating when absorbed by water or fat and this is the basis of microwave cooking. | Demonstrate a microwave e.g. using a bar of soap and marshmallows. | P4.2g | P1.1.9 |
| ELP2m | Know that radio waves produce electrical signals in metal aerials. | Demonstrate a crystal radio. | P4.2g | P1.1.9 |
| ELP2n | Recall two examples of uses of radio waves: radio; wireless links for laptop computers. | | P4.2g | P1.1.9 |
| ELP2o | Understand the advantages of wireless technology for global communications. | Discuss the advantages and disadvantages of wireless links for communication. | P4.2g | P1.1.9 |
| Suggested can-do tasks: U1, U2, U3 | | Suggested PAG: P4 | | |

ELP3 Medical rays

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELP3a | Understand the difference between the diagnosis of an illness and its treatment. | | | |
| ELP3b | Recall some benefits of a doctor being able to see inside a patient's body. | Consider why a doctor may need to see inside a patient's body to confirm a diagnosis. | | |
| ELP3c | Know that all surgical procedures have risks. | Discuss the risks of exploratory surgery. | | |
| ELP3d | Recall some medical uses of UV radiation. | Use case studies to learn about medical uses of UV radiation e.g. treating eczema and jaundice, revealing the presence of bacteria, setting dental fillings. | P4.2g | P1.1.9 |
| ELP3e | Know that exposure to UV radiation can cause suntan, sunburn and skin cancer. | | P4.2g | P1.1.8 |
| ELP3f | Understand that the use of UV radiation involves balancing benefits against risk. | Discuss the advantages and disadvantages of sun bathing. | P4.2g | P1.1.8 |
| ELP3g | Recall some ways of reducing the risk of exposure to UV radiation. | | P4.2g | P1.1.8 |
| ELP3h | Interpret data on the use of sunscreens [no recall expected]. | Show how sunblock works by spraying it onto white paper then illuminating it with a uv lamp. | | |
| ELP3i | Understand that bone absorbs X-rays and so produces shadow pictures. | Look at X-rays of normal and broken bones. | P4.2g | P1.1.9 |
| ELP3j | Know that too much exposure to X-rays is dangerous. | Discuss advantages and disadvantages of X-rays in medicine. | P4.2g | P1.1.8 |
| ELP3k | Understand that the use of X-rays involves balancing benefits against risk. | | P4.2g | P1.1.8 |

| ELP3 Medical rays | | | | |
|----------------------------|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP3l | Know that gamma radiation is very penetrating. | Watch a demonstration/simulation of the penetrating power of gamma radiation. Look at gamma camera images of the thyroid. | P4.2g | P1.1.8 |
| ELP3m | Know that a gamma camera detects gamma radiation and that a computer linked to it can make pictures. | Watch a demonstration/simulation of the penetrating power of gamma radiation. Discuss how radioactive chemicals can produce an image outside the patient's body. | P4.2g | P1.1.9 |
| ELP3n | Know that exposure to gamma rays is dangerous. | | P4.2g | P1.1.8 |
| ELP3o | Understand that the use of gamma rays involves balancing benefits against risk. | Watch a video showing procedures in the radiology department in a hospital to see how staff and patients are protected from unnecessary doses of X-rays. | P4.2g | P1.1.8 |
| ELP3p | Know that UV radiation, X-rays and gamma rays are part of a family called the electromagnetic spectrum. | | P4.2d | P1.1.9 |
| ELP3q | Know that UV radiation, X-rays and gamma rays can damage living cells. | Discuss the risks of nuclear medicine. | P4.2g | P1.1.8 |

| ELP4 Hot stuff | | | | |
|----------------------------|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP4a | Know that energy can be transferred as heat. | Circus of energy experiments. | P5.1c | P6.1.3 |
| ELP4b | Know that the main uses of heat are generating electricity, heating, cooking. | Record energy transfers as block flow charts. | P5.1c | P6.1.3 |
| ELP4c | Know that heat energy flows from a hot to a cooler body. | Discuss why a lump of ice held in the hand melts and why the hand feels cold. | P5.1c | P6.1.3 |
| ELP4d | Know that temperature is measured in °C and that heat is measured in J. | | | |
| ELP4e | Understand that the energy to change the temperature of a body depends on: its mass; the material it is made from; the temperature change. | Examine thermograms to see where hot spots occur. | P5.1c | P6.1.5a |
| ELP4f | Interpret simple data on heating/cooling experiments [no recall expected]. | Carry out experiments to measure the energy required to change the temperature of objects. | P5.1c | P6.1.3 |
| ELP4g | Recall and use the words: melting, boiling, freezing, condensing, evaporating. | | P1.2a | P6.2.2 |
| ELP4h | Using the particle model define density and explain the differences in density between the different states of matter in terms of the arrangements of the atoms or molecules. | | P1.1d | P6.1.1 |
| ELP4i | Describe how, when substances melt, freeze, evaporate, condense or sublimate, mass remains the same, but that these physical changes recover its original properties if the change is reversed. | | P1.2a | P6.2.2 |
| ELP4j | Describe what happens during a change of state in terms of internal energy, energy transfers and particle motions. | | P1.2e | P6.2.3 |

| ELP4 Hot stuff | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP4k | Know that a solar furnace uses radiation from the Sun focussed by a curved mirror. | | P6.2a | P1.1.9 |
| ELP4l | Understand that when light is absorbed by a material the energy of the material increases and it becomes hotter. | Build a solar collector from aluminium foil and an umbrella. | | |
| ELP4m | Know that a solar furnace is used for heating water which can be used for cooking or electricity generation. | | P6.2a | P1.1.9 |
| ELP4n | Know that hot air rises and is replaced by colder air. | | | |
| ELP4o | Know that metals are good conductors of heat and that trapped air and plastics are good insulators. | | P5.2f | P2.1.7 |
| ELP4p | Understand the terms <i>insulator</i> and <i>conductor</i> . | Apply the terms conductor and insulator to different materials. | P5.2f | P2.1.7 |
| ELP4q | Know that insulation reduces heat loss. | Investigate the insulating properties of packaging for takeaway foods. | P5.2g | P2.1.6 |
| ELP4r | Be able to design and carry out a test to evaluate the effectiveness of takeaway food packaging. | Find optimum thickness for loft insulation using a scientific model e.g. reducing heat loss in a cup of hot water using cloth/cardboard. | P5.2g | P2.1.7 |
| ELP4s | Calculate energy efficiency for any energy transfer, and describe ways to increase efficiency. | | P5.2d | P2.1.8 |
| ELP4t | Interpret simple data on home insulation [no recall expected]. | Compare temperature changes in insulated and non-insulated model houses. | P5.2g | P2.1.8 |
| Suggested can-do tasks: P3, U1, U2, U3, U4 | | Suggested PAGs: P1, P5 | | |

| ELP5 Alternative energy | | | | |
|----------------------------|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP5a | Understand that every power station needs an energy source. | | | |
| ELP5b | Recall that crude oil, coal and natural gas are fossil fuels used in power stations. | | | |
| ELP5c | Understand that fossil fuels are a limited energy source. | | | |
| ELP5d | Know that burning fossil fuels produces carbon dioxide which is a greenhouse gas. | | | |
| ELP5e | Know that greenhouse gases contribute to global warming. | | | |
| ELP5f | Understand that the demand for energy is increasing and this means that renewable sources will become more important. | Research to find different energy sources (e.g. http://www.cat.org.uk/index.html). | | |
| ELP5g | Know that some energy sources are renewable: wind, sunlight, waves, tide, geothermal, hydro-electric, biomass. | Discuss renewable energy resources. | P6.2a | P2.2.1 |
| ELP5h | Interpret information about the demand for energy and the availability of energy sources [no recall expected]. | | P6.2b | P2.2.7 |
| ELP5i | Know that wind turbines use energy from the wind to generate electricity. | Make a model windmill and investigate the angle of the blades and the use of a rudder. | P6.2a | P2.2.1 |
| ELP5j | Know that the up and down movement of water in a wave can be used to turn a turbine and so generate electricity. | Make a model 'bobbing duck' to produce electricity. | P6.2a | P2.2.1 |
| ELP5k | Describe in simple terms wave motion in terms of amplitude, wavelength, frequency and period. | | P4.1a | P1.3.1 |
| ELP5l | Define wavelength and frequency and describe and apply the relationship between these and the wave velocity. | | P4.1f | P1.3.6 |

ELP5 Alternative energy

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|---|--|---|
| ELP5m | Describe how ripples on water surfaces are examples of transverse waves and how the speed of each may be measured; describe evidence that it is the wave and not the water or air itself that travels. | | P4.1g | P1.3.2 |
| ELP5n | Describe the difference between transverse and longitudinal waves. | Demonstrate transverse waves with rope and longitudinal waves with a spring. | P4.1e | P1.3.4 |
| ELP5o | Know that the Sun is a source of energy. | Find out how the voltage of a photocell depends on distance from a lamp. | P6.2a | P2.2.1 |
| ELP5p | Know that photocells transform light into electrical energy. | Use a photocell to make electricity. | P6.2a | P1.1.9 |
| ELP5q | Know that photocells produce direct current. | Find out how photocells can be connected to increase their voltage. | P6.2a | P1.1.9 |
| ELP5r | Understand that photocells are useful sources of electricity for remote locations. | Discuss appropriate uses of photocells. | P4.2g | P1.1.9 |
| ELP5s | Know that heating a house requires a lot of energy and that alternative sources of heating can be used. | | P1.2c | P6.2.3 |
| ELP5t | Know that radiation from the Sun can be absorbed by a surface and transferred into heat. | | P4.2g | P1.1.9 |
| ELP5u | Be able to describe an experiment to show that black matt surfaces absorb more energy than white shiny surfaces. | Compare energy absorption by different coloured surfaces. | P4,2b | P1.1.4 |
| ELP5v | Know that solar panels have circulating water which is heated by radiation from the Sun. | Make a model solar panel using black rubber tubing and a small water pump e.g. from a windscreen washer to circulate the water. | P4.2g | P1.1.4 |

Suggested can-do tasks: P1, P2, P3, U1, U3, U4

ELP6 Nuclear power

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELP6a | Describe the atom as a nucleus surrounded by electrons. | | P1.1.b | P5.1.1 |
| ELP6b | Know the relative size of atoms and small molecules. | | P1.1.c | P5.1.3 |
| ELP6c | Know that scientists' ideas of what an atom look likes (called the atomic model) has changed over time. | | P1.1.a | P5.1.2 |
| ELP6d | Recall that atomic nuclei are composed of both protons and neutrons. | | P4.3a | P5.1.4 |
| ELP6e | Explain that isotopes are different forms of the same atom. | Discuss that atoms of the same elements can differ in nuclear mass by having different numbers of neutrons. | P4.3c | P5.1.6 |
| ELP6f | Know that changes in an atoms nucleus can generate radiation. | Demonstrate the atom decaying by making popcorn. | P4.3i | P1.1.7 |
| ELP6g | Be able to recognise a diagram of nuclear decay and give a simple description as to the process. | Simulate the fission of a large atom into smaller radioactive atoms. | P4.3i | P1.1.7 |
| ELP6h | Explain the concept of half-life and how this is related to the random nature of radioactive decay. | Demonstrate half-life with M&Ms throw them into the air then remove all the ones with the m uppermost. Half-life can also be demonstrated by measuring the decay of a head of beer in a measuring cylinder – cheaper beer works best as it produces a larger head. | P4.3j | P5.1.10 |
| ELP6i | Know that uranium is a non-renewable resource. | Watch an animation of a nuclear reactor to see how fission boils water in the steam generator. | P6.2a | P2.2.2 |

| ELP6 Nuclear power | | | | |
|----------------------------|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP6j | Know that in a nuclear power station, the uranium provides the source of energy. | | P6.2a | P2.2.1 |
| ELP6k | Know that a lot of energy is released by the splitting of uranium atoms. | | P4.3d | P5.1.7 P5.1.8 |
| ELP6l | Know that a nuclear power station produces harmful radioactive waste. | Watch a demonstration showing the penetration of radioactivity through different materials. | P4.3m | P5.2.2 |
| ELP6m | Know the differences between contamination and irradiation effects and compare the hazards associated with these two. | Discuss the safe siting of nuclear power stations. Find out about commissioning, operating and decommissioning nuclear power stations. Design a poster for use in school reminding teachers how to handle radioactive material safely. | P4.3m | P5.2.2 |
| ELP6n | Know that waste from nuclear power is: harmful; radioactive but is not a cause of global warming. | | P6.2a | P2.2.1 |
| ELP6o | Know that nuclear waste can be disposed of: low level waste in land fill sites (low level waste); by burying deep underground; by reprocessing. | Investigate different types of nuclear waste and how they are stored. Discuss the government's plans for disposing of nuclear waste. | P4.3m | P5.2.2 |
| ELP6p | Recall one risk and one benefit of nuclear power. | Consider the need for security of nuclear installations. | | |

| ELP7 Our electricity supply | | | | |
|-----------------------------|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP7a | Explain the difference between direct and alternating voltage. | Discuss appropriate uses for different batteries. | | |
| ELP7b | Know that batteries produce d.c. electricity from chemical reactions. | Make a fruit battery and investigating its properties. Make a chemical battery. | P5.2b | P2.1.1 |
| ELP7c | Know that the domestic supply in the UK is a.c. (at 50 Hz and about 230 volts). | | P6.2f | P2.2.4 |
| ELP7d | Know the main stages in the production of electricity: heat from the energy source changes water into steam, the steam is used to rotate turbines, turbines turn a generator, and the generator produces electricity. | Watch an animation showing how a power station works. Find out about the parts of a power station. Model a power station with a bicycle dynamo or steam engine. | P5.1c | P2.2.1 |
| ELP7e | Understand the terms <i>insulator</i> and <i>conductor</i> . | Discuss the terms with respect to electricity. | P5.2f | P2.1.6 |
| ELP7f | Know that electricity is transferred from a power station through a grid of high voltage transmission lines. | | P6.2c | P2.2.5 |
| ELP7g | Understand that transformers are required at either end of the transmission lines to increase or decrease voltage. | Assemble and test transformers with a.c. supplies and oscilloscopes. | P6.2e | P3.3.5 P3.3.6 |
| ELP7h | Know that a transformer is two coils of wire wound onto a core of iron. | Demonstrate a model transmission line system. | P6.2c | P3.3.5 |
| ELP7i | Know that electricity in the home is conducted by wires. | | P6.2c | P2.2.6 |

| ELP7 Our electricity supply | | | | |
|-----------------------------|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP7j | Know the differences in function between the live, neutral and earth mains wires, and the potential differences between these wires; hence explain that a live wire may be dangerous even when a switch in a mains circuit is open, and explain the dangers of providing any connection between the live wire and earth. | Design a leaflet to warn of the dangers of electrical wiring. | P6.2i | P2.2.6 |
| ELP7k | Know that current is a rate of flow of charge, that for a charge to flow, a source of potential difference and a closed circuit are needed and that a current has the same value at any point in a single closed loop. | Demonstrate electricity using a suitable model. | P3.1e | P3.1.1 |
| ELP7l | Know and use the relationship between quantity of charge, current and time. | | P3.1f | P3.1.2 |
| ELP7m | Know that current (I) depends on both resistance (R) and potential difference (V) and the units in which these are measured. | | P3.2c | P3.1.3 |
| ELP7n | Know and apply the relationship between I , R and V , and that for some resistors the value of R remains constant but that in others it can change as the current changes. | | P3.2c | P3.1.4a |
| ELP7o | Explain the design and use of circuits to explore such effects – including for lamps, diodes, thermistors and LDRs. | | P3.2c | P3.2.2a |

| ELP7 Our electricity supply | | | | |
|---|--|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP7p | Describe the difference between series and parallel circuits, explain why, if two resistors are in series the net resistance is increased, whereas with two in parallel the net resistance is decreased (qualitative explanation only). | Construct and test series and parallel circuits. | P3.2a | P3.2.2a |
| ELP7q | Calculate the currents, potential differences and resistances in d.c. series circuits, and explain the design and use of such circuits for measurement and testing purposes; represent them with the conventions of positive and negative terminals, and the symbols that represent common circuit elements, including diodes, LDRs and thermistors. | Test electrical circuits and draw the circuit diagrams. | P3.2j | P3.1.7 |
| ELP7r | Know that some appliances use more electricity than others. | Demonstration of electricity meter. | P5.2b | P2.1.8 |
| ELP7s | Know ways of reducing energy loss from the home. | | P5.2f | P2.1.8 |
| ELP7t | Interpret data for different energy saving strategies focusing on the choice of energy saving appliances [no recall expected]. | | P5.2f | P2.1.8 |
| Suggested can-do tasks: P3, P4, U1, U3, U4 | | Suggested PAG: P6 | | |

| ELP8 Attractive forces | | | | |
|----------------------------|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP8a | Know that iron and steel are magnetic. | Test materials to see if they are magnetic. | P2.2a | P4.1.2 |
| ELP8b | Know how to induce magnetism in a pin. | Investigate games using magnets (fishing, theatre). | | |
| ELP8c | Know that magnets attract magnetic materials: limited to iron and steel. | | P3.3a | |
| ELP8d | Know that like poles repel and unlike poles attract. | | P3.3a | P3.4.1 |
| ELP8e | Know how iron filings or a compass can be used to show up a magnetic field. | Find where magnetic fields are strongest and weakest on a bar magnet. Find the magnetic field of a magnet by using iron filings. | P3.3c | P3.4.2 |
| ELP8f | Know that a freely swinging magnet comes to rest in a N-S direction. | Make a compass. | P3.3c | P3.4.3 |
| ELP8g | Know that the Earth has a magnetic field around it. | Use a compass to plan a route around a school. | P3.3c | P3.4.3 |
| ELP8h | Understand how a compass works and why it is so useful. | Follow a route using a compass. | P3.3d | P3.4.3 |
| ELP8i | Know that the Earth's magnetic field protects us from cosmic rays. | Find out about the Earth's magnetic field. Use the internet to find out about the 'Northern Lights'. | P3.3d | P3.4.3 |
| ELP8j | Know that a current-carrying wire behaves like a magnet. | | P3.3d | P3.4.3 |

| ELP8 Attractive forces | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP8k | Know how to construct an electromagnet. | Make an electromagnet and use it to sort aluminium and steel drinks cans. | P3.3a | |
| ELP8l | Understand how the strength of an electromagnet depends on: the number of turns on the coil, the current in the coil. | Make and test an electromagnet. Devise ways of improving the electromagnet. | P3.3a | P3.4.8 |
| ELP8m | Understand that the core of an electromagnet is made of iron because iron is a temporary magnet. | | P3.3b | P3.4.8 |
| ELP8n | Know that the strength of the field depends on the current and the distance from the conductor, and explain how solenoid arrangements can enhance the magnetic effect. | | P3.3f | P3.4.7 |
| ELP8o | Be able to label the magnet, core and cone in a loudspeaker. | Make and use a loudspeaker. | P3.3c | P3.4.7 P3.4.8 |
| ELP8p | Be able to plan how to compare how the number of turns on the coil (or strength of magnet) affects how well a loudspeaker works. | | P3.3c | P3.4.7 P3.4.8 |
| ELP8q | Recall uses of electromagnets limited to: MRI scan, sorting scrap metals, lifting iron/steel/cars. | | P3.3c | P3.4.7 P3.4.8 |
| Suggested can-do tasks: P1, P4, U1, U3, U4 | | | | |

ELP9 Pushes and pulls

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|--|---|--|---|
| ELP9a | Know that forces can be pulls, pushes, twists or bends. | Explore the size and feel of a range of forces. Investigate types and operation of screwdrivers, spanners, levers etc. | P2.2a | P4.1.2 |
| ELP9b | Know that forces are measured in Newtons. | Make and testing a Newton meter (spring-balance). Test the breaking strain of a fishing line. | | |
| ELP9c | Understand that unbalanced forces change the motion of an object. | | P2.2b P2.2c | P4.1.3 |
| ELP9d | Know that gravity is a force pulling things towards the Earth. | Measure gravity force using a Newton meter. | P2.2c | P4.1.5 |
| ELP9e | Understand that weight is due to the force of gravity. | | P2.3h | P4.1.7 |
| ELP9f | Know that an objects gravitational potential energy is composed of its mass, height and gravity. | | P5.1e | P4.4.1 |
| ELP9g | Know that falling objects are acted on by gravity and drag. | Measure the speed of falling objects. Make parachutes. | P2.1d | P4.2.5 |
| ELP9h | Understand the effect of air resistance on falling objects. | Investigate gliders and airplanes. | P2.3i | P4.2.11 |
| ELP9i | Know that falling objects can reach a maximum speed. | | P2.3i | P4.2.11 |
| ELP9j | Know that a stretched elastic band exerts a force. | Make model bungee ropes and test them. | P1.1a | P6.3.6a |
| ELP9k | Know that an increased force increases the length of an elastic material. | | P2.3a | P6.3.5 |

| ELP9 Pushes and pulls | | | | |
|---|---|--------------------------------------|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP9l | Give a simple description of the relationship between force and extension in stretching a spring. | | P2.2l | P6.3.3a |
| ELP9m | Know that the extension of an elastic material is proportional to the force applied to it. | | P5.1e | P6.3.5 |
| ELP9n | Know that elastic materials return to their original shape unless the force becomes too big. | | P2.3b | P6.3.2 |
| ELP9o | Apply the relationship between work done = force × distance moved. | | P2.2l | |
| Suggested can-do tasks: P1, P2, P3, U1, U3, U4 | | Suggested PAG: P2 | | |

| ELP10 Driving along | | | | |
|----------------------------|---|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP10a | Recall and be able to use: speed = distance ÷ time. | Survey speeds outside the school by timing cars over a given distance. | P2.1b | P4.4.2 |
| ELP10b | Understand that speed limits were introduced to save fuel and improve road safety. | Watch a road safety video. | P6.1d | P4.3.13 |
| ELP10c | Know that the national speed limit is 60 mph on most roads, 70 mph on motorways and dual carriageways. | | P6.1d | P4.3.13 |
| ELP10d | Understand why speed limits are less than the national limits in towns, outside schools and other areas. | | P6.1d | P4.3.13 |
| ELP10e | Relate the amounts of energy associated with a moving body (limited to faster speed = more energy). | | P5.1e | P4.4.1 |
| ELP10f | Describe with examples where there are energy transfers in a system, that there is no net change to the total energy of a closed system (qualitative only). | | P5.1a | P2.1.4 |
| ELP10g | Describe, with examples, how in all system changes, energy is dissipated, so that it is stored in less useful ways. | | P5.2a | P2.1.5 |
| ELP10h | Know that more power is required to stop a fast moving car (during braking energy is converted to heat in the brakes—the faster the speed the faster the energy needs to be converted to heat). | Design a poster for a road safety campaign to reduce speeding. | P2.2n | P2.1.2 |

| ELP10 Driving along | | | | |
|---|--|--|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP10i | Know that thinking distance is the distance travelled between seeing danger and starting to brake. | | P6.1d | P4.3.11 |
| ELP10j | Explain methods of measuring human reaction times and recall typical results. | Measure reaction time by dropping calibrated 'ruler' between fingers. | P6.1d | P4.3.11 |
| ELP10k | Know that braking distance is the distance travelled whilst braking. | Mark out thinking distances, braking distances and stopping distances on playground or field for speeds up to 100 mph. | P6.1e | P4.3.12 |
| ELP10l | Know that: stopping distance = thinking distance + braking distance. | | P6.1e | P4.3.12 |
| ELP10m | Interpret data from table of thinking, braking and stopping distances [no recall expected]. | | P6.1e | P4.3.12 |
| ELP10n | Explain the dangers caused by large decelerations. | Talk about the links between traffic speed and injury. Design a poster for a road safety campaign to reduce speeding. | P6.1e | P4.3.13 |
| ELP10o | Know that crumple zones in vehicles reduce the impact force. | Build crumple zones on model cars and test them. | P6.1e | P4.3.13 |
| ELP10p | Know that air bags and seatbelts reduce impact forces for occupants. | | P6.1e | P4.3.13 |
| Suggested can-do tasks: P1, P2, P3, U1, U4 | | Suggested PAG: P3 | | |

ELP11 Fly me to the moon

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|---|--|---|
| ELP11a | Know that the moon orbits the Earth. | <p>What causes an eclipse of the Sun?</p> <p>Find out about the Moon.</p> <p>Plan a space expedition to the Moon.</p> | | |
| ELP11b | Know the order of the eight planets in the solar system. | <p>Devise a mnemonic to remember the names of the planets in our solar system e.g. 'My Very Excellent Mother Just Served Us Noodles'.</p> <p>Make a simple model of the solar system.</p> | | |
| ELP11c | Interpret information about the planets and other bodies in the Universe [no recall expected]. | <p>Use the internet to find out about planets around stars other than the Sun.</p> <p>Discuss the chances of life on other planets.</p> | | |
| ELP11d | Know that other planets have moons. | Find out which other planets have moons. | | |
| ELP11e | Know that large rockets are needed to put things in space. | <p>Discuss how gravity needs to be overcome to put objects into space.</p> <p>Test a compressed air and water rocket.</p> <p>Find out about chemically-fuelled rockets used in firework displays.</p> | P5.1b | P4.4.7 |
| ELP11f | Apply Newton's first law to explain why a rocket on a launch pad remains where it is before take-off. | | P2.2d | P4.3.6 |
| ELP11g | Know that Newton's second law is used by scientists to work out how the rocket lifts off the pad relating forces, masses and accelerations $F = ma$. | | P2.2i | P4.3.5 |

| ELP11 Fly me to the moon | | | | |
|----------------------------|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP11h | Explain how the thrust of the rocket is provided by heating a gas to increase its volume. | | P1.2g | P6.2.4 |
| ELP11i | Explain how the motion of the molecules in a gas is related both to its temperature and its pressure: (qualitative only). | Discuss that the hotter the temperature the faster the particles move. The more particles the more collisions and therefore the greater pressure. | P1.2g | P6.2.4 |
| ELP11j | Explain what would happen if you had a blockage in a rocket motor. | | P1.2h | P6.2.4 |
| ELP11k | Recall Newton's third law to the forces of the rocket. | Discuss that the force of the fuel going one way pushes the rocket the other way. | P2.2o | P4.1.1 |
| ELP11l | Apply Newton's law to explain why the rocket in space keeps a constant speed. | Show the feather penny free-fall in a vacuum experiment. | P2.2o | P4.1.1 |
| ELP11m | Know that some parts of some rockets/ shuttles return to the Earth and can be reused. | Show a video of the Space shuttle or SpaceX. | | |
| ELP11n | Understand that manned spacecraft need resources that unmanned spacecraft do not e.g. oxygen, food, water. | Investigate voyager and pioneer spacecraft. | | |
| ELP11o | Know that other (artificial) satellites orbit the Earth and are used for communication, mapping, spying and tracking. | | | |

Suggested can-do tasks: P1, P2, P3, U1, U3, U4

ELP12 Final frontiers

| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
|----------------------------|---|--|--|---|
| ELP12a | Know that the Sun is at the centre of our solar system. | | | |
| ELP12b | Know that the Sun is a star. | | | |
| ELP12c | Know that the Earth orbits the Sun. | | | |
| ELP12d | Recall that the Earth moves in its orbit through space at an enormous speed. | Work out the speed of the Earth and relate this to how long it would take to get to Sydney, Australia. | | |
| ELP12e | Understand that other planets take longer/shorter times to orbit the Sun if they are further/nearer to the Sun. | Discuss what would be different if the expedition was going to Mars or Neptune. | | |
| ELP12f | Interpret information about the planets and other bodies in the Universe [no recall expected]. | | | |
| ELP12g | Know that space contains many stars of which the Sun is one. | Find out the name of the nearest stars to our Solar System. | | |
| ELP12h | Know that the Sun is a star in the Milky Way galaxy. | | | |
| ELP12i | Know that there are billions of stars in the Milky Way. | | | |
| ELP12j | Know that there are billions of galaxies in the Universe. | Discuss whether we would ever be able to visit another galaxy. | | |
| ELP12k | Be able to compare the sizes of the moon, the Earth, the Sun, the Milky Way and the Universe. | | | |
| ELP12l | Know that astronomers use astronomical telescopes to study the sky. | Use a telescope to look at the moon. | | |

| ELP12 Final frontiers | | | | |
|----------------------------|---|---|--|---|
| EL in science content ref. | Content statement | Suggested activities and experiences | GCSE (9–1) Gateway A combined science ref. | GCSE (9–1) 21st Century Science B combined science ref. |
| ELP12m | Know that the Sun is a source of light. | Recognise the difference between luminous and non-luminous objects. | | |
| ELP12n | Know that planets and moons reflect light which enable them to be seen. | | | |
| ELP12o | Know that it is dangerous to look at the Sun. | Discuss why you must NEVER look at the Sun with a telescope. | | |
| ELP12p | Understand that light pollution and dust in the atmosphere interferes with observations by astronomers. | | | |
| ELP12q | Know that astronomers have discovered planets around other stars. | Investigate the Hubble space telescope. | | |

