

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 children'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 children are exposed to high quality teaching and learning experiences, which allow children to explore their outdoor environment and locality, thus developing their scientific enquiry and investigative skills.
- They are immersed in scientific vocabulary, which aids children's knowledge and understanding not only of the topic they are studying, but of the world around them.
- The Board of Trustees which comprises experts in SEN and in particular ASD, have been actively involved in curriculum design. This means that the curriculum is fit for purpose for children with special educational needs. A large part of the curriculum is experiential as it is important for children on the autism spectrum to be able to make cohesive links that are not abstract. A fully immersive experience is required. Examples include through World Book Day, author and poet visits and a range of trips and visits which enrich and complement children's learning.

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 GCSE units to help us in planning Science. These units have been created to develop children's enthusiasm for and knowledge and understanding of science. With a key emphasis on hands-on learning, children develop their investigation skills while securing their grasp of key scientific principles. Children 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 bespoke and whole school training programme which enables them to meet the individual needs of pupils in relation to their diagnosis of ASD and other co-morbidities together with subject specific/curriculum training. Examples include: Understanding Autism, how the developing brain works, visits to other schools to observe and learn from best practice, subject specific training, memberships and participation in subject associations, participating in curriculum meetings, access to on-line resources – for example Optimus Education.
- Quality Assurance activities include: half-termly book monitoring, learning walks, formal and informal lesson observations, including peer to peer observations, pupil surveys and curriculum team meetings.

Impact

- The impact and measure of this is to ensure children 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 SIMs 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.
- 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 children 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 children 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 children 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.

Curriculum Overview

- * Our curriculum is designed with our children in mind but is subject to change. Units may be moved around to suit children'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

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 1	Animals Including Humans	Seasonal Changes (Autumn and Winter)	Everyday Materials	Plants	Seasonal Changes (Spring and Summer)	Scientists and Inventors
Year 2	Animals Including Humans	Living Things and Their Habitats	The Environment	Uses of Everyday Materials	Plants	Scientists and Inventors

KS2

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 3	Animals Including Humans	Plants	Light	Rocks	Forces and Magnets	Scientists and Inventors
Year 4	Animals Including Humans	Sound	States of Matter	Electricity	Living Things and Their Habitats	Scientists and Inventors
Year 5	Animals Including Humans	Properties and Changes of Materials	Earth and Space	Forces	Living Things and Their Habitats	Scientists and Inventors
Year 6	Animals Including Humans	Light	Evolution and Inheritance	Electricity	Living Things and Their Habitats	Scientists and Inventors

KS3

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 7	Cells Acids and Alkalis	Energy Resources Reproduction	Simple Chemical Reactions Electrical Circuits	Environment and Feeding Relationships The Particle Model	Forces and their Effects Variation and Classification	Solutions The Solar System and Beyond
Year 8	Food and Digestion Atoms and Elements	Heating and Cooling Respiration	Compounds and Mixtures Magnets and Electro Magnets	Microbes and Disease Rocks and Weathering	Light Ecological Relationships	The Rock Cycle Sound and Hearing

KS4

Students in Key Stage 4 will study the AQA Science Entry Level Certificate and GCSE.

There are six teaching components in total, two for each of biology, chemistry and physics. In all three sciences, students develop their understanding of how scientific principles and concepts help describe complex and diverse natural phenomena in terms of a small number of key ideas. They also develop relevant practical skills.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 9	Forces/Forces & Motion Astronomy Rockets & Solar System	Senses Environmental Chemistry	Immune System Metal Recycling	Waves Electromagnetic Waves	Waves in Medicine Temperature	Reproduction Acids & Alkalis
Year 10	Control Systems Periodic Table	Respiratory System Materials	Circulatory System Purifying Mixtures	Food Factory Digestive System	Cells Physical & Chemical Change	Genes Lab Skills Forensic Science
Year 11	Extinction Rates of Reaction	Reaction & Electrolysis Ecosystems & Fieldwork Fuels	Alternative Energy Nuclear Power	Electricity Electromagnetism	Revision	Revision

Detailed Curriculum Map

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 1	Animals Including Humans	Seasonal Changes (Autumn and Winter)	Everyday Materials	Plants	Seasonal Changes (Spring and Summer)	Scientists and Inventors
Learning Objectives Covered	<p>Animals (including humans)</p> <ul style="list-style-type: none"> identify and name a variety of common animals including fish, amphibians, reptiles, birds and mammals identify and name a variety of common animals that are carnivores, herbivores and omnivores describe and compare the structure of a variety of common animals (fish, amphibians, reptiles, birds and mammals, including pets) 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>Seasonal Changes</p> <ul style="list-style-type: none"> observe changes across the four seasons describe weather associated with the seasons and how day length varies. 	<p>Everyday Materials</p> <ul style="list-style-type: none"> distinguish between an object and the material from which it is made identify and name a variety of everyday materials, including wood, plastic, glass, metal, water, and rock describe the simple physical properties of a variety of everyday materials compare and group together a variety of everyday materials on the basis of their simple physical properties. 	<p>Plants</p> <ul style="list-style-type: none"> identify and name a variety of common wild and garden plants, including deciduous and evergreen trees identify and describe the basic structure of a variety of common flowering plants, including trees. 	<p>Seasonal Changes</p> <ul style="list-style-type: none"> observe changes across the four seasons describe weather associated with the seasons and how day length varies. 	<p>Objectives from across the year in context</p> <p>Working Scientifically</p> <ul style="list-style-type: none"> asking simple questions and recognising that they can be answered in different ways observing closely, using simple equipment performing simple tests identifying and classifying using their observations and ideas to suggest answers to quest

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 2	Animals Including Humans	Living Things and Their Habitats	The Environment	Uses of Everyday Materials	Plants	Scientists and Inventors
Learning Objectives Covered	<p>Animals, Including Humans</p> <ul style="list-style-type: none"> notice that animals, including humans, have offspring which grow into adults find out about and describe the basic needs of animals, including humans, for survival (water, food and air) describe the importance for humans of exercise, eating the right amounts of different types of food, and hygiene. 	<p>Living Things & Their Habitats</p> <ul style="list-style-type: none"> explore and compare the differences between things that are living, dead, and things that have never been alive 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 plants, and how they depend on each other identify and name a variety of plants and animals in their habitats, including micro-habitats 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>Working Scientifically</p> <ul style="list-style-type: none"> asking simple questions and recognising that they can be answered in different ways observing closely, using simple equipment performing simple tests identifying and classifying using their observations and ideas to suggest answers to questions gathering and recording data to help in answering questions. 	<p>Uses of Everyday Materials</p> <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 by squashing, bending, twisting and stretching. 	<p>Plants</p> <ul style="list-style-type: none"> observe and describe how seeds and bulbs grow into mature plants find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. 	<p>Objectives from across the year in context</p> <p>Working Scientifically</p> <ul style="list-style-type: none"> asking simple questions and recognising that they can be answered in different ways observing closely, using simple equipment performing simple tests identifying and classifying using their observations and ideas to suggest answers to questions gathering and recording data to help in answering questions.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 3	Animals Including Humans	Plants	Light	Rocks	Forces and Magnets	Scientists and Inventors
Learning Objectives Covered	<p>Animals (including humans)</p> <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 identify that humans and some other animals have skeletons and muscles for support, protection and movement. 	<p>Plants</p> <ul style="list-style-type: none"> 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 investigate the way in which water is transported within plants explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal. 	<p>Light</p> <ul style="list-style-type: none"> recognise that they 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 find patterns in the way that the size of shadows change. 	<p>Rocks</p> <ul style="list-style-type: none"> 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>Forces & Magnets</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. 	<p>Objectives from across the year in context</p> <p>Working Scientifically</p> <ul style="list-style-type: none"> asking relevant questions and using different types of scientific enquiries to answer them setting up simple practical enquiries, comparative and fair tests making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers gathering, recording, classifying and presenting data in a variety of ways to help in answering questions recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions identifying differences, similarities or changes related to simple scientific ideas and processes using straightforward scientific evidence to answer questions or to support their findings.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 4	Animals Including Humans	Sound	States of Matter	Electricity	Living Things and Their Habitats	Scientists and Inventors
Learning Objectives Covered	<p>Animals (including humans)</p> <ul style="list-style-type: none"> describe the simple functions of the basic parts of the digestive system in humans identify the different types of teeth in humans and their simple functions construct and interpret a variety of food chains, identifying producers, predators and prey. 	<p>Sound</p> <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 find patterns between the pitch of a sound and features of the object that produced it find patterns between the volume of a sound and the strength of the vibrations that produced it recognise that sounds get fainter as the distance from the sound source increases. 	<p>States of Matter</p> <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, and measure or research the temperature at which this happens in degrees Celsius (°C) identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature. 	<p>Electricity</p> <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. 	<p>Living Things & Their Habitats</p> <ul style="list-style-type: none"> recognise that living things can be grouped in a variety of ways explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment recognise that environments can change and that this can sometimes pose dangers to living things. 	<p>Objectives from across the year in context</p> <p>Working Scientifically</p> <ul style="list-style-type: none"> asking relevant questions and using different types of scientific enquiries to answer them setting up simple practical enquiries, comparative and fair tests making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers gathering, recording, classifying and presenting data in a variety of ways to help in answering questions recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables reporting on findings from enquiries, including oral and written explanations, displays or presentations of results and conclusions using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions identifying differences, similarities or changes related to simple scientific ideas and processes using straightforward scientific evidence to answer questions or to support their findings.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 5	Animals Including Humans	Properties and Changes of Materials	Earth and Space	Forces	Living Things and Their Habitats	Scientists and Inventors
Learning Objectives Covered	<p>Animals (including humans)</p> <ul style="list-style-type: none"> describe the changes as humans develop to old age. 	<p>Properties & Changes of Materials</p> <ul style="list-style-type: none"> compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic 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, including changes associated with burning and the action of acid on bicarbonate of soda. 	<p>Earth & Space</p> <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 night and the apparent movement of the sun across the sky. 	<p>Forces</p> <ul style="list-style-type: none"> 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 recognise that some mechanisms, including levers, pulleys and gears, allow a smaller force to have a greater effect. 	<p>Living Things & their Habitats</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 and animals. 	<p>Objectives from across the year in context</p> <p>Working Scientifically</p> <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.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 6	Animals Including Humans	Light	Evolution and Inheritance	Electricity	Living Things and Their Habitats	Scientists and Inventors
Learning Objectives Covered	<p>Animals (including humans)</p> <ul style="list-style-type: none"> identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function describe the ways in which nutrients and water are transported within animals, including humans. 	<p>Light</p> <ul style="list-style-type: none"> recognise that light appears to travel in straight lines use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them. 	<p>Evolution & Inheritance</p> <ul style="list-style-type: none"> recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution. 	<p>Electricity</p> <ul style="list-style-type: none"> associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches use recognised symbols when representing a simple circuit in a diagram. 	<p>Living Things & their Habitats</p> <ul style="list-style-type: none"> describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals give reasons for classifying plants and animals based on specific characteristics. 	<p>Objectives from across the year in context</p> <p>Working Scientifically</p> <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.

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 7	Cells Acids and Alkalis	Energy Resources Reproduction	Simple Chemical Reactions Electrical Circuits	Environment and Feeding Relationships The Particle Model	Forces and their Effects Variation and Classification	Solutions The Solar System and Beyond
Learning Objectives Covered	<ul style="list-style-type: none"> learn that cells are the basic units of life and are organised into tissues from which organs are made explore cell structure and differences between plant and animal cells learn about some functions of cells learn about acids and alkalis as classes of chemicals with distinct properties and uses use indicators to classify solutions as acidic, alkaline or neutral use the pH scale to compare the acidity and alkalinity of different solutions begin to explore neutralisation 	<ul style="list-style-type: none"> are introduced to the concept of energy in the context of fuels as convenient and therefore valuable sources consider the nature and origin of fossil fuels and renewable sources of energy and how their use has implications for the environment consolidate and extend their ideas about energy resources for living things: food for people and sunlight for plants link the energy resources to the role of the Sun as the ultimate source of most of the Earth's energy resources extend their earlier ideas about human reproduction and consider how offspring are protected and nurtured consider and compare reproductive patterns in other animals with those in humans relate what they know of the way their bodies change during adolescence to knowledge about human reproduction, growth and the menstrual cycle 	<ul style="list-style-type: none"> are introduced to the idea that chemical change results in new substances that are different from the ones from which they were made explore some simple chemical reactions of acids in which a gas is made explore burning as a chemical reaction involving a gas, air or oxygen identify hydrogen and carbon dioxide as substances made during some of these reactions work with gases to understand that gases are real materials begin to use word equations as shorthand descriptions of reactions consolidate and extend their ideas about circuits use concepts of electric current and energy transfer to explain the working of circuits explain patterns in the measurements of current and voltage use the concept of resistance qualitatively build circuits in which current flow is usefully controlled consider the hazards of electricity for humans 	<ul style="list-style-type: none"> how habitats vary how plants and animals are adapted to live in a particular habitat how plants and animals interact with their environment and with each other, including feeding relationships about adaptations for feeding how to link food chains to make webs learn how the particle model can be used to explain differences between solids, liquids and gases explore how experimental evidence relates to theories and models 	<ul style="list-style-type: none"> consolidate and build on their concept of force and its measurement identify the origin of friction, air resistance, upthrust and weight and describe situations in which these forces act distinguish between mass and weight use the concept of speed relate forces acting to changes in motion identify situations in which forces are balanced and unbalanced explore variation within and between species consider why classification is important and are introduced to scientific classification of animals investigate patterns of variation in living things and ways of representing and explaining the occurrence of variations 	<ul style="list-style-type: none"> extend their knowledge of dissolving and the separation of the components of a solution and relate this to particle theory begin to distinguish between a 'pure' substance and a mixture apply the particle model of solids, liquids and gases in a range of contexts consolidate their ideas about the Sun and Moon, and use models of these to explain phenomena such as eclipses and the seasons learn that planets and satellites are seen by reflected light and that the Sun, as a star, emits light compare the Sun with other stars

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 8	Food and Digestion Atoms and Elements	Heating and Cooling Respiration	Compounds and Mixtures Magnets and Electro Magnets	Microbes and Disease Rocks and Weathering	Light Ecological Relationships	The Rock Cycle Sound and Hearing
Learning Objectives Covered	<ul style="list-style-type: none"> • about different foods and how they can be combined to produce a balanced diet • how food is broken down by digestion so it can be used by the body, for energy, growth and repair • learn that the huge range of materials is made from a relatively small number of elements • learn that each element is composed of one sort of atom only • explore the characteristics of some elements • use the particle model to describe what happens when elements combine 	<ul style="list-style-type: none"> • recognise the need for a temperature scale • learn to distinguish between heat (as energy) and temperature • learn about mechanisms of heat transfer: conduction, convection and radiation, and apply this to familiar contexts • learn about expansion and change of state in solids, liquids and gases • use the particle model to explain conduction, convection and change of state • how cells are supplied with the materials they need for respiration • how cells in animals and plants release energy • that the process of respiration is similar in all cells 	<ul style="list-style-type: none"> • distinguish between elements and compounds and how they are represented by symbols and formulae • recognise chemical change as a process in which atoms join together in new ways • distinguish between compounds and mixtures • distinguish between chemical reactions in which new compounds are formed and the formation of mixtures • identify magnetic materials, make a magnet and test the strength of a magnet • use the concepts of a magnetic field, a permanent magnet and an electromagnet • investigate factors affecting the strength of an electromagnet • explain the working of a number of devices that use magnets and electromagnets 	<ul style="list-style-type: none"> • learn that micro-organisms share the characteristics of other living things • find out about growing micro-organisms to make products, and about the role of micro-organisms in infectious diseases • learn about the body's defence systems and how immunisation can protect against microbial infections • learn about rock texture as one of the key characteristics of different rock types • model rock texture • learn about the processes of weathering, erosion, transportation and sedimentation • relate processes, <i>eg evaporation and dissolving</i>, involved in rock formation to processes observed in other contexts • consider processes operating on different timescales 	<ul style="list-style-type: none"> • build on their knowledge of light and its effects • learn how we see objects • represent light as a ray and use this concept to explain reflection and refraction • find out about the origin of coloured light and the appearance of coloured objects • study a habitat in detail and learn how: <ul style="list-style-type: none"> – organisms can be identified and sizes of populations compared – feeding relationships can be modelled quantitatively – living things within a community influence each other and are affected by the environment 	<ul style="list-style-type: none"> • learn about the major rock-forming processes • learn how rock-forming processes are linked by the rock cycle • use the concept of rock texture as one of the key characteristics of igneous, sedimentary and metamorphic rocks • relate processes observed in other contexts, <i>eg crystallisation</i>, to processes involved in the rock cycle • consider processes operating on different timescales • build on their knowledge of sound and hearing • explain how sound travels through media • give an explanation of how the ear works, find out about the harmful effects of loud noise and how loud noise can be reduced

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 9 Entry Level Certificate	Forces/Forces & Motion Astronomy Rockets & Solar System	Senses Environmental Chemistry	Immune System Metal Recycling	Waves Electromagnetic Waves	Waves in Medicine Temperature	Reproduction Acids & Alkalis
Learning Objectives Covered	<ul style="list-style-type: none"> Know that forces can be pulls, pushes, twists or bends. Know that forces are measured in Newtons Understand that unbalanced forces change the motion of an object Know that gravity is a force pulling things towards earth Understand that weight is due to the force of gravity Know that an objects gravitational potential energy is composed of its mass, height and gravity Know that falling objects are acted on by gravity and drag Understand the effect of air resistance on falling objects Know that falling objects can reach a maximum speed Know that a stretched elastic band exerts a force. Know that an increased force increases the 	<ul style="list-style-type: none"> Be able to label a diagram of the eye (limited to cornea, iris, pupil, lens, retina, optic nerve). Recall the job of the pupil, lens, retina, optic nerve and iris. Know that the nose is lined with nerves sensitive to chemicals in the air. Recall that taste buds are located on the tongue and are sensitive to four tastes: salt, sweet, sour, bitter. Know that different areas of the tongue are more sensitive to different tastes. Understand that the flavour of food diminishes when we have a cold and cannot smell. Know that sensor (receptor) cells detect stimuli, and effector cells (muscles) produce a response. Understand the need for simple reflex actions, i.e. for 	<ul style="list-style-type: none"> Describe the relationship between health and disease. Describe different types of diseases Know that if you are infected with two diseases it may make you feel worse. Know that plants can get diseases too. Recall that harmful microbes (pathogens) are bacteria, fungi, protists and viruses. Describe a minimum of one common human infection plus a sexually transmitted infection in humans, including HIV/AIDS. Understand that our bodies provide good conditions for microbes to reproduce rapidly. Recall that the skin, chemicals in tears, sweat, and stomach acid stop microbes getting in. Know that microbes can enter the body through natural openings, or cuts in the skin. Know that white blood cells are part of the immune system. 	<ul style="list-style-type: none"> Describe how sound waves in air are longitudinal waves. Explain how the motion of the molecules in a gas is related to its pressure e.g. shouting versus whispering. Know that even when whispering voice can be overheard. Know that coding a message increases its security. Understand that light can be used for communication but requires the use of digital code (e.g. Morse code). Know that digital signals are either on (1) or off (0). Know that light travels through space at a speed of 300 000 km/s. Understand how using light allows messages to be transmitted quickly. Understand how light travels along an optical fibre from one end to the other by reflection. Know that optical fibres transmit data very quickly. 	<ul style="list-style-type: none"> Understand the difference between the diagnosis of an illness and its treatment. Recall some benefits of a doctor being able to see inside a patient's body. Know that all surgical procedures have risks. Recall some medical uses of UV radiation. Know that exposure to UV radiation can cause suntan, sunburn and skin cancer. Understand that the use of UV radiation involves balancing benefits against risk. Recall some ways of reducing the risk of exposure to UV radiation. Interpret data on the use of sunscreens Understand that bone absorbs X-rays and so produces shadow pictures. Know that too much exposure to X-rays is dangerous. 	<ul style="list-style-type: none"> Recall the names of the main organs of the female reproductive system Recall the names of the main organs of the male reproductive system Recall the functions of testes (make sperm), ovary (make eggs). Recall that normal body cells have 46 chromosomes: females have 23 pairs (including xx); males have 22 pairs and an odd pair (xy). Know that sperm and egg cells have 23 chromosomes each. Know that fertilisation occurs by the fusion of a sperm and an egg cell, which produces a fertilised egg with 46 chromosomes. Recall that the fertilised egg develops into a foetus. 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. Know that chemicals called hormones are involved in reproduction to include

	<p>length of an elastic material</p> <ul style="list-style-type: none"> Give a simple description of the relationship between force and extension in stretching a spring. Know that the extension of an elastic material is proportional to the force applied to it. Know that elastic materials return to their original shape unless the force becomes too big. Apply the relationship between work done = force \times distance moved. Recall and be able to use: speed = distance \div time. Understand that speed limits were introduced to save fuel and improve road safety. Know that the national speed limit is 60 mph on most roads, 70 mph on motorways and dual carriageways. Understand why speed limits are less than the national limits in towns, outside schools and other areas. Relate the amounts of energy associated with a moving body. 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 Describe, with examples, how in all system 	<ul style="list-style-type: none"> protection. Recall examples of simple reflex actions limited to knee jerk, iris, touching a hot surface. Interpret simple data on reaction times. Know that the skin contains sensory nerves for touch, temperature, pain and pressure. Know that pressure sensors are deeper than pain sensors. Know that some areas of skin contain more nerve endings than others. Know that the Earth is surrounded by a mixture of gases called the atmosphere. Know how the atmosphere was formed and has changed over time. Know that the atmosphere now contains about 80% nitrogen and 20% oxygen. Know that there are smaller amounts of water vapour, carbon dioxide and other gases in the air. Know that fuels contain carbon, which forms carbon dioxide when the fuel burns. Know how to test for the presence of carbon dioxide. 	<ul style="list-style-type: none"> Know that the immune system fights infections. With reference to infection explain how white blood cells, platelets and plasma are adapted to their functions in the blood. Describe the process of discovery and development of new medicines. Know that antibiotics are chemicals that kill bacteria and fungi, but not viruses. Know that some bacteria have evolved which are not killed by some antibiotics. Know that vaccines can make people immune to a disease. Know that a vaccine usually contains a safe form of a disease-causing microorganism. Know that once you are immune you are protected from a particular disease. Understand different viewpoints that parents may have about giving their child a vaccination. Understand that media reports of health studies are not always accurate. Describe the properties of metals on the basis of their characteristic physical and chemical properties. Position carbon in the reactivity series of metals. Know how some metals (e.g. iron and copper) can be extracted by heating its ore with carbon. Know that rusting needs iron, water and oxygen. 	<ul style="list-style-type: none"> Know that light is not the only method of transmitting a signal digitally there are other examples which use the electromagnetic spectrum. Know that household remote control devices use infrared radiation. Know that wireless communication devices use radio waves. Understand the advantages of wireless technology for radio, mobile telephones and laptop computers. Know that mobile phones use microwave signals. Know that sound and images can be transmitted digitally. Know that the main reason for switching to digital television and radio is the improved quality of picture and sound. Know that visible light is part of a group of waves called the electromagnetic spectrum. Know that all waves from the electromagnetic spectrum travel at the speed of light. Be able to list the colours of the visible spectrum in order from red to violet. Know that a rainbow is a naturally occurring example of the visible spectrum. Know that a visible spectrum can be produced when white 	<ul style="list-style-type: none"> Understand that the use of X-rays involves balancing benefits against risk. Know that gamma radiation is very penetrating. Know that a gamma camera detects gamma radiation and that a computer linked to it can make pictures. Know that exposure to gamma rays is dangerous. Understand that the use of gamma rays involves balancing benefits against risk. Know that UV radiation, X-rays and gamma rays are part of a family called the electromagnetic spectrum. Know that UV radiation, X-rays and gamma rays can damage living cells. Know that energy can be transferred as heat. Know that the main uses of heat are generating electricity, heating, cooking. Know that heat energy flows from a hot to a cooler body. Know that temperature is measured in $^{\circ}\text{C}$ and that heat is measured in J. Understand that the energy to change the temperature of a body 	<p>male: testosterone and female: oestrogen and progesterone.</p> <ul style="list-style-type: none"> Recall some of the changes that occur in the female body after fertilisation: stopping periods and gaining weight. Know that periods start again after childbirth. Explain the use of hormones in contraception and evaluate hormonal and non-hormonal methods of contraception. Be able to label simple laboratory apparatus used to obtain a dye from a plant Know that the colour of some dyes can be changed by adding acids and alkalis. Understand safety precautions when using acids or alkalis. Interpret simple information about the use of indicators to classify solutions as acid, neutral or alkali. Know how to use the pH scale. Know that pH can be measured electronically. Know that neutralisation occurs when acids and alkalis are mixed. Understand the uses of neutralisation, limited to curing indigestion and reducing the acidity of soils. Know that excess acid in the stomach is a cause of indigestion. Interpret simple information comparing the
--	---	---	---	--	--	---

	<p>changes, energy is dissipated, so that it is stored in less useful ways.</p> <ul style="list-style-type: none"> • Know that more power is required to stop a fast moving car • Know that thinking distance is the distance travelled between seeing danger and starting to brake. • Explain methods of measuring human reaction times and recall typical results. • Know that braking distance is the distance travelled whilst braking. • Know that: stopping distance = thinking distance + braking distance. • Interpret data from table of thinking, braking and stopping distances • Explain the dangers caused by large decelerations. • Know that crumple zones in vehicles reduce the impact force. • Know that air bags and seatbelts reduce impact forces for occupants. <p>• Know that the Sun is at the centre of our solar system.</p> <ul style="list-style-type: none"> • Know that the Sun is a star. • Know that the Earth orbits the Sun. • Recall that the Earth moves in its orbit through space at an 	<ul style="list-style-type: none"> • Know that the amount of carbon dioxide in the atmosphere is slowly increasing. • Know that the increasing level of carbon dioxide is linked to global warming. • Know that burning fuels may add harmful chemicals into the atmosphere. • Know that these harmful chemicals are called pollutants. • Understand some of the problems these pollutants cause. • Know that carbon monoxide forms when fuels from crude oil burn in a limited supply of air. • Know that fossil fuels contain small amounts of sulfur which are released as sulfur dioxide when the fuel is burnt. • Know that sulfur dioxide is a cause of acid rain. • Know that nitrogen and oxygen from the air can make nitrogen oxides in a car engine. • Know that a catalytic converter gets rid of pollutants like nitrogen oxides. • Interpret simple data on the removal of pollutants from car exhausts. • Be able to state the benefits and drawbacks 	<ul style="list-style-type: none"> • Explain reduction and oxidation in terms of loss or gain of oxygen, identifying if iron is being reduced or oxidised when rusting. • Know that paints are used to decorate or protect surfaces. • Know that salt water speeds up rusting. • Be able to describe similarities and differences between the properties of iron and aluminium • Know that electrolysis is used to extract some metals (e.g. aluminium) from their ores because they are more reactive than carbon. • Know that the aluminium is formed at the cathode non-metals are formed at the anode in electrolysis using inert electrodes. • Recall one advantage and one disadvantage of making cars from aluminium. • Interpret simple information about metals used to make cars. • Understand why metals are worth recycling • Interpret information on the recycling of materials 	<p>light passes through a prism.</p> <ul style="list-style-type: none"> • Know that a laser produces a narrow, intense beam of light. • Recall uses of lasers limited to: read CDs, light shows, pointers, weapon guidance, cutting tools. • Know that warm and hot objects emit infrared radiation. • Know that passive infrared sensors and thermal imaging cameras work by detecting body heat. • 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. • Recall two examples of uses of microwave radiation from: cooking; mobile phones; radar; communication with satellites. • Know that microwaves cause heating when absorbed by water or fat and this is the basis of microwave cooking. • Know that radio waves produce electrical signals in metal aerials. • Recall two examples of uses of radio waves: radio; wireless links for laptop computers. • Understand the advantages of wireless 	<p>depends on: its mass; the material it is made from; the temperature change.</p> <ul style="list-style-type: none"> • Interpret simple data on heating/cooling experiments • Recall and use the words: melting, boiling, freezing, condensing, evaporating. • 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. • 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. • Describe what happens during a change of state in terms of internal energy, energy transfers and particle motions. • Know that a solar furnace uses radiation from the Sun focussed by a curved mirror. • Understand that when light is absorbed by a material the energy of the material increases and it becomes hotter. • Know that a solar furnace is used for 	<p>effectiveness of different indigestion remedies</p>
--	---	--	---	--	--	--

	<p>enormous speed.</p> <ul style="list-style-type: none"> • Understand that other planets take longer/shorter times to orbit the Sun if they are further/nearer to the Sun. • Interpret information about the planets and other bodies in the Universe. • Know that space contains many stars of which the Sun is one. • Know that the Sun is a star in the Milky Way galaxy. • Know that there are billions of stars in the Milky Way. • Know that there are billions of galaxies in the Universe. • Be able to compare the sizes of the moon, the Earth, the Sun, the Milky Way and the Universe. • Know that astronomers use astronomical telescopes to study the sky. • Know that the Sun is a source of light. • Know that planets and moons reflect light which enable them to be seen. • Know that it is dangerous to look at the Sun. • Understand that light pollution and dust in the atmosphere interferes with observations by astronomers. • Know that astronomers have discovered planets 	<p>of using catalytic converters.</p> <ul style="list-style-type: none"> • Know that exhaust gas emissions are part of an MOT vehicle test. 		<p>technology for global communications.</p>	<p>heating water which can be used for cooking or electricity generation.</p> <ul style="list-style-type: none"> • Know that hot air rises and is replaced by colder air. • Know that metals are good conductors of heat and that trapped air and plastics are good insulators. • Understand the terms insulator and conductor. • Know that insulation reduces heat loss. • Be able to design and carry out a test to evaluate the effectiveness of takeaway food packaging. • Calculate energy efficiency for any energy transfer, and describe ways to increase efficiency. • Interpret simple data on home insulation 	
--	--	--	--	--	---	--

	<p>around other stars.</p> <ul style="list-style-type: none"> • Know that the moon orbits the Earth. • Know the order of the eight planets in the solar system. • Interpret information about the planets and other bodies in the Universe. • Know that other planets have moons. • Know that large rockets are needed to put things in space. • Apply Newton's first law to explain why a rocket on a launch pad remains where it is before take-off. • 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 • Explain how the thrust of the rocket is provided by heating a gas to increase its volume. • Explain how the motion of the molecules in a gas is related both to its temperature and its pressure • Explain what would happen if you had a blockage in a rocket motor. • Recall Newton's third law to the forces of the rocket. • Apply Newton's law to explain why the rocket in space keeps a 					
--	--	--	--	--	--	--

	<p>constant speed.</p> <ul style="list-style-type: none">• Know that some parts of some rockets/shuttles return to the Earth and can be reused.• Understand that manned spacecraft need resources that unmanned spacecraft do not e.g. oxygen, food, water.• Know that other (artificial) satellites orbit the Earth and are used for communication, mapping, spying and tracking.					
--	--	--	--	--	--	--

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 10 Entry Level Certificate	Control Systems Periodic Table	Respiratory System Materials	Circulatory System Purifying Mixtures	Food Factory Digestive System	Cells Physical & Chemical Change	Genes Lab Skills Forensic Science
Learning Objectives Covered	<ul style="list-style-type: none"> Understand that changes in our surroundings can affect our body's internal environment. Understand that the body's internal environment can change and that the body tries to control this change, use temperature regulation as an example. Know the ways the body gains or loses water. Be able to name and locate the kidneys and the bladder. Know that kidneys remove excess water and urea. Know that blood sugar levels need to be controlled. Know that the body controls blood sugar levels with insulin. Be able to name and locate the pancreas. Know that insulin is produced by the pancreas. 	<ul style="list-style-type: none"> Be able to name and locate the windpipe, lungs and ribs on a diagram of the thorax. Understand that lung volumes vary and may be affected by smoking. Understand that the speed of ventilation varies and may be affected by smoking. Know that smoking can cause heart disease and cancer. Recall that tobacco smoke contains carbon monoxide, nicotine, tars and solid particles. Know that carbon monoxide is odourless, colourless and poisonous. Know that nicotine is addictive and that nicotine patches can be used to help someone give up smoking. Interpret data relating to health studies on smoking. Know that other people may be affected by passive smoking. 	<ul style="list-style-type: none"> Understand the importance of maintaining the supply of oxygen to the body. Know that the heart is made of muscle. Know that the heart pumps to force blood out to the lungs or around the body. Know that the heart acts as a double pump. Know that arteries carry blood away from the heart, and veins to the heart. Be able to recognise the difference between an artery and a vein. Know why the heart muscles need a good blood supply. Explain how red blood cells and plasma are adapted to their functions in the blood. Know that energy is needed for muscle contraction. Understand that during exercise muscles need to be supplied with more oxygen and be able to relate this to an increase in heart rate. Know the equation for respiration. Compare the processes of aerobic and anaerobic respiration to include the 	<ul style="list-style-type: none"> Know that plants make their own food from carbon dioxide in the air and water. Know that this process is called photosynthesis. Know that plants also need light to make their own food. Explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis. Know that plants make sugars and some is stored as starch. Know that oxygen is a waste product of photosynthesis. Explain how the structure of xylem and phloem are adapted to their functions in the plant. Explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function. Describe the processes of transpiration and translocation, including 	<ul style="list-style-type: none"> Recall the life processes: movement, respiration, sensitivity, growth, reproduction, excretion, and nutrition. Be able to name the body systems involved with these life processes: circulatory, respiratory and digestive. Be able to label the nucleus, cytoplasm and cell membrane of an animal cell. 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. Know that cells get substances in by diffusion, and active transport Know that new cells are made when cells divide. Know that new body cells are needed for growth and repair. 	<ul style="list-style-type: none"> Know that human cells contain a nucleus. 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. Know that chromosomes are made of DNA. Describe DNA as two strands forming a double helix. Know that lengths of DNA in chromosomes are genes. Know that our DNA carries our unique genetic code. Describe the genome as the entire genetic material of an organism. Know that most human features are determined by a person's genes. 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. Understand that environment also affects many features.

	<ul style="list-style-type: none"> • Know that diabetes can be managed by controlling sugar levels in the diet and use of insulin. • Know the relative size of atoms and small molecules. • Know that scientists' ideas of what an atom looks like has changed over time. • Describe the atom as a nucleus surrounded by particles called electrons. • Recall relative charges and approximate relative masses of protons, neutrons and electrons. • Explain how the position of an element in the Periodic Table is related to its atomic number • Use the names and symbols of common elements from the Periodic Table. • Use the names and symbols of the first Groups 1, 7 and 0 elements from the Periodic Table. • 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 • Recognise that the atomic structure of metals and non- metals 	<ul style="list-style-type: none"> • Know that in all cells, glucose from food and oxygen breathed in combine to release energy and that this process is called respiration. • Know that carbon dioxide and water are the waste products of respiration. • Recall how to test breath for carbon dioxide using limewater, and for water vapour with a mirror or cobalt chloride paper. • Know that carbon dioxide is removed from our bodies via the lungs. • Know that during exercise, more oxygen and glucose is needed by muscles, and water and carbon dioxide are removed more quickly. • Know that carbon can form four bonds • Know that carbon can form many compounds because it can arrange itself into a variety of shapes limited to chains and rings. • Explain the properties of diamond, graphite, fullerenes and graphene in terms of their structures and bonding. • Using graphite and diamond explain that their different properties are related to the arrangements of bonds they contain. • Interpret simple data comparing the 	<p>products of both reactions and their effects.</p> <ul style="list-style-type: none"> • Interpret simple data on breathing and pulse rates during exercise • Understand that a cut to a major blood vessel is more serious than a cut to a capillary. • Know that heart disease often happens when arteries supplying the heart with blood become blocked. • 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. • Explain what is meant by the purity of a substance, distinguishing between the scientific and everyday use of the term 'pure'. • Know that a mixture contains two or more uncombined substances. • Know that mixtures contain substances that can be separated from each other. • Suggest suitable separation techniques given information about the substances. • Be able to plan how to obtain a soluble substance (e.g. salt, copper sulfate or sugar) from an aqueous solution by crystallisation. • Be able to plan how to separate an insoluble substance from water by filtration e.g. sand. 	<p>the structure and function of the stomata.</p> <ul style="list-style-type: none"> • 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. • Know that plants make their own food from carbon dioxide in the air and water. • Know that this process is called photosynthesis. • Know that plants also need light to make their own food. • Explain the effect of temperature, light intensity and carbon dioxide concentration on the rate of photosynthesis. • Know that plants make sugars and some is stored as starch. • Know that oxygen is a waste product of photosynthesis. • Explain how the structure of xylem and phloem are adapted to their functions in the plant. • Explain how water and mineral ions are taken up by plants, relating the structure of the root hair cells to their function. • Describe the processes of transpiration and translocation, including the structure and function of the stomata. • Explain the effect of a variety of environmental factors on the rate of 	<ul style="list-style-type: none"> • Know that cancer can be caused when cell division is out of control. • Know that bigger organisms have cells that are adapted for different roles to include nerve cells/root hair cells/red blood cells. • Know that stem cells are cells that can change into other cells. • Know that stem cells can be used in medicine to repair the body. • Explain states of matter using the particle model. • Explain changes of state using the particle model. • Describe the physical states of products and reactants using state symbols: (s), (l), (g) and (aq). • Plan an experiment to work out the melting point of a solid. • Use data to predict states of substances under given conditions. • Explain chemical reactions using the particle model. • Use ideas about the behaviour of particles and bonds to explain what happens during of state. • Know that during a change of state the 	<ul style="list-style-type: none"> • Understand that most features are affected by several genes, e.g. height. • Interpret data on human variation. • Know that some genes are dominant and some are recessive. • Know how to use simple Punnett squares to show inheritance of genotype ratios. • Know that some diseases are caused by 'faulty genes'. • Know that embryos can be tested for certain genes. • Understand that people have different viewpoints about such testing. • Know ways of monitoring the progress of a reaction. • Interpret information from charts and graphs about rates of reaction. • Understand how particle collisions can be used to explain reaction rates. • Know that increasing temperature usually speeds up chemical reactions. • Know that lowering the temperature (in a refrigerator or freezer) slows down the changes that make food go bad. • Know that increasing the concentration increases the speed of a chemical reaction. • 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
--	---	---	--	---	--	---

	<p>relates to their position in the Periodic Table.</p> <ul style="list-style-type: none"> • Explain that isotopes are different forms of the same atom with a different number of neutrons. • Calculate numbers of protons, neutrons and electrons in atoms given their atomic number and mass 	<p>properties of different materials</p> <ul style="list-style-type: none"> • Know that a composite material contains at least two different materials. • Know that an alloy is a mixture of two or more elements, at least one of which is a metal. • Know the names and one use of the alloys: steel, solder, aluminium alloy and brass. • Know that the properties of alloys are different from the properties of the metals from which they are made. • Interpret information linking the properties of materials to their uses • Understand the term 'smart' alloy. 	<ul style="list-style-type: none"> • Know how chromatography is used to separate mixtures into their constituents. • Interpret simple chromatograms. • Suggest how chromatography can be used to test pure from impure substances. • Following a chromatography experiment measure the distance moved by the solvent and the spots. • Calculate the R_f value from the spots by dividing the distance moved by the spot by the distance moved by the solvent. • Understand that distillation is used to separate liquids with different boiling points. • Know that distillation is used to produce some alcoholic drinks, e.g. whisky. • Use melting point data to distinguish pure from impure substances. • Know how drinking water is purified. 	<p>water uptake by a plant, to include light intensity, air movement and temperature.</p> <ul style="list-style-type: none"> • Know that being overweight or underweight is linked to increased health risks. • Understand that regular exercise is important for a healthy lifestyle. • Know that regular exercise reduces the risk of heart disease. • Know that different people have different dietary requirements. • Understand, in simple terms, the processes of digestion and absorption and where these events occur. • Know that enzymes speed up reactions in humans. • Understand that enzymes speed up digestion to produce smaller soluble chemicals (which can pass into the blood by diffusion). • Know that there are different enzymes in the mouth, stomach and intestines, each of which digests a different type of food. • Know that drugs can be beneficial or harmful. • Know that a drug is a chemical that has an effect on the mind or the body. • Know that some drugs are addictive. 	<p>mass of the substance remains the same.</p> <ul style="list-style-type: none"> • 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. • Know that some reactions may be reversed 	<p>pan balance, stop clock/digital watch.</p> <ul style="list-style-type: none"> • Know that the rate of reaction is increased when several small lumps of solid are used rather than a few large lumps. • Understand that a difference in the rate of reaction can be explained by a difference in the surface area. • Know that catalysts can alter the rate of a reaction but are not used up in the reaction. • Explain that to get a reaction to start often energy has to be supplied e.g. heat by a Bunsen burner. • State that activation energy is the energy that needs to be added to start a chemical reaction. • Label the activation energy on a graph showing the energy profile of a reaction. • Interpret simple information on the use of different catalysts • Know that enzymes act as catalysts in biological systems. • Know that anyone present at a crime scene will • leave some evidence behind. • Understand why crime scene investigators wear special clothing to avoid leaving evidence at a crime scene. • Know how an investigator collects evidence at a
--	---	--	--	---	---	---

				<ul style="list-style-type: none"> • Know how the effect of caffeine on heart rate can be measured. • Know that alcohol abuse accounts for more deaths and crime than any other drug. • Know the short term effects of alcohol (limited to blurred vision, slurred speech, poor balance and slower reactions). • Know the dangers of drink driving. • Know the long term effects of alcohol 		<ul style="list-style-type: none"> • crime scene – in precisely labelled evidence bags. • Know fingerprints are left on a surface because oils from the skin are deposited. • Know how dusting a surface with a special powder can make fingerprints show up. • Know how fingerprints can be removed from a surface. • Know how to make a record of a person's fingerprints. • Understand that innocent people have their fingerprints taken for elimination. • Recognise loop, arch and whorl as features of fingerprints. • Know that no two people have identical fingerprints – not even identical twins. • Know that blood contains red blood cells, white blood cells, platelets and plasma. • Recall that the main blood groups are A, B, AB and O. • Know how chromatography can be used to separate colours in ink. • Understand how the results of separating colours can identify a particular ink as being used e.g. to write a forged cheque. • Know that DNA is inherited from parents. • Know that identical twins have identical DNA but otherwise DNA is unique. • Interpret data from a crime scene and decide whether or not it confirms a suspect's presence.
--	--	--	--	--	--	--

	Term 1	Term 2	Term 3	Term 4	Term 5	Term 6
Year 11 Entry Level Certificate	Extinction Rates of Reaction	Reaction & Electrolysis Ecosystems & Fieldwork Fuels	Alternative Energy Nuclear Power	Electricity Electromagnetism	Revision	
Learning Objectives Covered	<ul style="list-style-type: none"> Know that fossils provide evidence of living organisms from long ago to include fossil formation. Know that living things have been changing through evolution. Understand the term species. Know that some species have changed very little over thousands of years e.g. crocodiles. Be able to identify variations in animals or plants of the same species Know that all variations in a species arise from mutations. Understand that living things compete for shelter, food and mates, in order to survive. Know that the better adapted individuals will survive and can breed and pass on their features to the next generation. Understand the term habitat. 	<ul style="list-style-type: none"> Using sodium and chlorine show how atoms can donate electrons. 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). Construct dot-and-cross diagrams for sodium chloride Know that after reacting the mass of salt produced should be the same as the mass of sodium and chlorine gas. Calculate masses of the product of a simple chemical reaction when given the reactants in a balanced chemical equation. Recognise representations of atomic models Use chemical symbols to write the formulae of elements and simple 	<ul style="list-style-type: none"> Understand that every power station needs an energy source. Recall that crude oil, coal and natural gas are fossil fuels used in power stations. Understand that fossil fuels are a limited energy source. Know that burning fossil fuels produces carbon dioxide which is a greenhouse gas. Know that greenhouse gases contribute to global warming. Understand that the demand for energy is increasing and this means that renewable sources will become more important. Know that some energy sources are renewable: wind, sunlight, waves, tide, geothermal, hydro-electric, biomass. Interpret information about the demand for energy and the availability of energy sources Know that wind turbines use energy from the wind to generate electricity. 	<ul style="list-style-type: none"> Explain the difference between direct and alternating voltage. Know that batteries produce d.c. electricity from chemical reactions. Know that the domestic supply in the UK is a.c. (at 50 Hz and about 230 volts). Know the main stages in the production of electricity Understand the terms insulator and conductor. Know that electricity is transferred from a power station through a grid of high voltage transmission lines. Understand that transformers are required at either end of the transmission lines to increase or decrease voltage. Know that a transformer is two coils of wire wound onto a core of iron. Know that electricity in the home is conducted by wires. Know the differences in function between the live, 		

	<ul style="list-style-type: none"> • Understand that a species may become extinct if their habitat changes or another species is better adapted to survive there. • Understand how human beings have caused some species to become endangered or extinct: habitat destruction, hunting, pollution. • Know that the rates of chemical reactions can vary greatly. • Interpret simple visual images showing different rates of chemical reactions. • Know that a reaction stops when one of the reacting substances is used up. • 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. • Deduce an order of reactivity of alkali metals based on their reaction with water. • 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. • Predict possible reactions and probable 	<p>compounds limited to sodium chloride, magnesium oxide, sodium hydroxide, hydrochloric acid, hydrogen and carbon dioxide.</p> <ul style="list-style-type: none"> • 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. • From a model or a diagram to work out the proportion of sodium and chlorine atoms in a molecule of sodium chloride. • 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. • 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. • 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. 	<ul style="list-style-type: none"> • Know that the up and down movement of water in a wave can be used to turn a turbine and so generate electricity. • Describe in simple terms wave motion in terms of amplitude, wavelength, frequency and period. • Define wavelength and frequency and describe and apply the relationship between these and the wave velocity. • 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. • Describe the difference between transverse and longitudinal waves. • Know that the Sun is a source of energy. • Know that photocells transform light into electrical energy. • Know that photocells produce direct current. • Understand that photocells are useful sources of electricity for remote locations. • Know that heating a house requires a lot of energy and that alternative sources of heating can be used. • Know that radiation from the Sun can be absorbed by a surface and transferred into heat. • Be able to describe an experiment to show that black matt surfaces absorb 	<p>neutral and earth mains wires, and the potential differences between these wires</p> <ul style="list-style-type: none"> • 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. • Know and use the relationship between quantity of charge, current and time. • Know that current (I) depends on both resistance (R) and potential difference (V) and the units in which these are measured. • Know and apply the relationship between I, R and V • Explain the design and use of circuits to explore such effects – including for lamps, diodes, thermistors and LDRs. • 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 • 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 	
--	---	--	---	--	--

	<p>reactivity of elements from their positions in the Periodic Table limited to Group 1, 7 and 0.</p> <ul style="list-style-type: none"> • Know that magnesium, zinc and iron react with acids to make hydrogen gas. • Know the test for hydrogen. • Deduce an order of reactivity of magnesium, zinc and iron based on their reaction with acid. • Know ways of monitoring the progress of a reaction. • Interpret information from charts and graphs about rates of reaction. • Understand how particle collisions can be used to explain reaction rates. • Know that increasing temperature usually speeds up chemical reactions. • Know that lowering the temperature (in a refrigerator or freezer) slows down the changes that make food go bad. • Know that increasing the concentration increases the speed of a chemical reaction. • Be able to label simple laboratory apparatus used to find out about rates of reaction • Know that the rate of reaction is increased when several small lumps of solid are used rather than a few large lumps. 	<ul style="list-style-type: none"> • Know that after electrolysis the theoretical mass of sodium and chlorine gas produced should be the same as the starting mass of salt. • Know that at the cathode electrons are added to the positively charged sodium to remake sodium metal. • Predict which electrode magnesium metal will be made during the electrolysis of magnesium chloride. • Know the names of other chemical bonds limited to covalent and metallic bonds. • Know that animals get their food from eating plants or other animals. • Know that may different materials cycle through an ecosystem. • Explain the importance of the carbon cycle and the water cycle to living organisms. • Explain that microorganisms are involved in the cycling of materials through an ecosystem. • Understand how some animals are adapted as successful predators. • Understand the terms herbivore and carnivore. • Be able to construct a simple food chain with 	<p>more energy than white shiny surfaces.</p> <ul style="list-style-type: none"> • Know that solar panels have circulating water which is heated by radiation from the Sun. • Describe the atom as a nucleus surrounded by electrons. • Know the relative size of atoms and small molecules. • Know that scientists' ideas of what an atom look likes (called the atomic model) has changed over time. • Recall that atomic nuclei are composed of both protons and neutrons. • Explain that isotopes are different forms of the same atom. • Know that changes in an atoms nucleus can generate radiation. • Be able to recognise a diagram of nuclear decay and give a simple description as to the process. • Explain the concept of half-life and how this is related to the random nature of radioactive decay. • Know that uranium is a non-renewable resource. • Know that in a nuclear power station, the uranium provides the source of energy. • Know that a lot of energy is released by the splitting of uranium atoms. • Know that a nuclear power station produces harmful radioactive waste. 	<ul style="list-style-type: none"> • Know that some appliances use more electricity than others. • Know ways of reducing energy loss from the home. • Interpret data for different energy saving strategies focusing on the choice of energy saving appliances • Know that iron and steel are magnetic. • Know how to induce magnetism in a pin. • Know that magnets attract magnetic materials • Know that like poles repel and unlike poles attract. • Know how iron filings or a compass can be used to show up a magnetic field. • Know that a freely swinging magnet comes to rest in a N-S direction. • Know that the Earth has a magnetic field around it. • Understand how a compass works and why it is so useful. • Know that the Earth's magnetic field protects us from cosmic rays. • Know that a current-carrying wire behaves like a magnet. • Know how to construct an electromagnet. • Understand how the strength of an electromagnet depends on: the number of turns on the coil, the current in the coil. • Understand that the core of an electromagnet is 	
--	--	---	--	---	--

	<ul style="list-style-type: none"> • Understand that a difference in the rate of reaction can be explained by a difference in the surface area. • Know that catalysts can alter the rate of a reaction but are not used up in the reaction. • Explain that to get a reaction to start often energy has to be supplied e.g. heat by a Bunsen burner. • State that activation energy is the energy that needs to be added to start a chemical reaction. • Label the activation energy on a graph showing the energy profile of a reaction. • Interpret simple information on the use of different catalysts • Know that enzymes act as catalysts in biological systems. 	<p>a plant, a herbivore and a carnivore.</p> <ul style="list-style-type: none"> • Be able to interpret a simple food web • Understand how a change affecting one species in a food web can affect another species in the same food web. • Be able to describe and carry out simple sampling methods: limited to pooters, nets, pitfall traps and quadrat surveys. • Be able to use simple keys to name plants and animals. • Describe that DNA is now used to help classify organisms. • Know the meaning of the term habitat. • Understand that organisms are adapted to live in their habitat. • Be able to estimate the number of plants in an area using results of a quadrat survey. • Describe the impact of humans on biodiversity. • Explain some of the reasons why scientists want to maintain biodiversity. • Know that crude oil is a toxic, dark, sticky liquid. • Know that crude oil is made mainly of hydrocarbons in chains of varying length. 	<ul style="list-style-type: none"> • Know the differences between contamination and irradiation effects and compare the hazards associated with these two. • Know that waste from nuclear power is: harmful; radioactive but is not a cause of global warming. • Know that nuclear waste can be disposed of • Recall one risk and one benefit of nuclear power. 	<p>made of iron because iron is a temporary magnet.</p> <ul style="list-style-type: none"> • 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. • Be able to label the magnet, core and cone in a loudspeaker. • 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. • Recall uses of electromagnets limited to: MRI scan, sorting scrap metals, lifting iron/steel/cars. 	
--	--	---	---	--	--

		<ul style="list-style-type: none">• Know that hydrocarbons are composed of hydrogen and carbon.• Recognise that the formula of hydrocarbons will contain carbons, hydrogens and numbers.• 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.• Know that modern life is crucially dependent upon hydrocarbons from crude oil and recognise that crude oil is a finite resource.• Know that crude oil is a good source of hydrocarbons that are used to make many products we enjoy and rely on.• Know that crude oil can be separated into more useful parts at an oil refinery.• Know that in an oil refinery crude oil is separated into fractions based on the boiling point of the hydrocarbon.• Know that petroleum gases, petrol, kerosene and diesel are all hydrocarbons that come from crude oil.• 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.

- Understand that some fuels ignite more easily than others do and that this is important for their uses.
- Know that burning fuels produces energy for heating, transport and making electricity in power stations.
- Be able to label the apparatus used to find out how much energy a flame gives out.
- Interpret data to decide which fuel gives out most energy when the same amount burns.
- Give one advantage and one disadvantage of petrol and diesel for transport.
- Interpret simple information about the use of different fuels
- Understand that people can make choices about which fuels to use.
- 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.
- Know that plastics are made from these small

		<ul style="list-style-type: none">• molecules called monomers.• Know that lots of monomers join together to form a long chain polymer.			
--	--	---	--	--	--