Curriculum Scheme

Science

The Eastwood Academy

Believe, Succeed, Together

Curriculum Scheme

The fundamental aim of a curriculum scheme is to coherently plan and sequence the cumulative acquisition of subject content to facilitate retention, recall and application.

CREATE Curriculum

Curriculum schemes are underpinned by the CREATE Curriculum which brings together the key interrelated aspects of curriculum structure, design and delivery into a single coherent entity.

CREATE Element	Description
Challenge	Stretch and extend learning to foster a deeper understanding beyond the content of the National Curriculum and GCSE specifications.
Regulate	Plan, monitor and evaluate specific aspects of learning to foster greater responsibility and independence – DRAFT.
Enhance	Consolidate and develop transferable literacy and numeracy skills.
Adapt and Assess	Adapt teaching to take account of different pupils' needs and provide an opportunity for all pupils to achieve. Undertake regular in-class assessment to monitor strengths and highlight specific areas of improvement.
Target	Consolidate identified strengths and develop and overcome areas of improvement.
Enrich	Enhance physical and emotional wellbeing; develop social, spiritual, moral and cultural capital; and provide opportunities and experiences to successfully transition to the next stage from secondary education.

Curriculum Allocation

Year Group	7	8	9	10	11
Number of Lessons	3	3	4	4	4

Curriculum Intent

Science is a National Curriculum core subject – refer to National Curriculum Science Programmes of Study

Key Stage 1-2

Learning Intentions
KS1 and KS2 National Curriculum Science Programmes of Study

Key Stage 3

Learning Intentions
Working Scientifically *Scientific Attitudes* • Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility. • Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review. • Evaluate risks. *Experimental Skills and Investigations* • Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience. • Make predictions using scientific knowledge and understanding. • Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables. • Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety. • Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements. • Apply sampling techniques.

Analysis and Evaluation

- Apply mathematical concepts and calculate results/
- Present observations and data using appropriate methods, including tables and graphs.
- Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions.
- Present reasoned explanations, including explaining data in relation to predictions and hypotheses.
- Evaluate data, showing awareness of potential sources of random and systematic error.
- Identify further questions arising from their results.

Measurement

- Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature.
- Use and derive simple equations and carry out appropriate calculations.
- Undertake basic data analysis including simple statistical techniques.

Biology

Structure and Function of Living Organisms

Cells and Organisation

- Cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope.
- The functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts.
- The similarities and differences between plant and animal cells.
- The role of diffusion in the movement of materials in and between cells.
- The structural adaptations of some unicellular organisms.
- The hierarchical organisation of multicellular organisms: from cells to tissues to organs to systems to organisms.

The Skeletal and Muscular Systems

- The structure and functions of the human skeleton, to include support, protection, movement and making blood cells.
- Biomechanics – the interaction between skeleton and muscles, including the measurement of force exerted by different muscles.

- The function of muscles and examples of antagonistic muscles.

Nutrition and Digestion

- The content of a healthy human diet: carbohydrates, lipids (fats and oils), proteins, vitamins, minerals, dietary fibre and water, and why each is needed.
- Calculations of energy requirements in a healthy daily diet.
- The consequences of imbalances in the diet, including obesity, starvation and deficiency diseases.
- The tissues and organs of the human digestive system, including adaptations to function and how the digestive system digests food (enzymes simply as biological catalysts).
- The importance of bacteria in the human digestive system.
- Plants making carbohydrates in their leaves by photosynthesis and gaining mineral nutrients and water from the soil via their roots.

Gas Exchange Systems

- The structure and functions of the gas exchange system in humans, including adaptations to function.
- The mechanism of breathing to move air in and out of the lungs, using a pressure model to explain the movement of gases, including simple measurements of lung volume.
- The impact of exercise, asthma and smoking on the human gas exchange system.
- The role of leaf stomata in gas exchange in plants.

Reproduction

- Reproduction in humans (as an example of a mammal), including the structure and function of the male and female reproductive systems, menstrual cycle (without details of hormones), gametes, fertilisation, gestation and birth, to include the effect of maternal lifestyle on the foetus through the placenta.
- Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.

Health

- The effects of recreational drugs (including substance misuse) on behaviour, health and life processes.

Material Cycles and Energy

Photosynthesis

- The reactants in, and products of, photosynthesis, and a word summary for photosynthesis.
- The dependence of almost all life on Earth on the ability of photosynthetic organisms, such as plants and algae, to use sunlight in photosynthesis to build organic molecules that are an essential energy store and to maintain levels of oxygen and carbon dioxide in the atmosphere.
- The adaptations of leaves for photosynthesis.

Cellular Respiration

- Aerobic and anaerobic respiration in living organisms, including the breakdown of organic molecules to enable all the other chemical processes necessary for life.
- A word summary for aerobic respiration.
- The process of anaerobic respiration in humans and micro-organisms, including fermentation, and a word summary for anaerobic respiration.
- The differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism.

Interactions and Interdependencies

Relationships in an Ecosystem

- The interdependence of organisms in an ecosystem, including food webs and insect pollinated crops.
- The importance of plant reproduction through insect pollination in human food security.
- How organisms affect, and are affected by, their environment, including the accumulation of toxic materials.

Genetics and Evolution

Inheritance, Chromosomes, DNA and Genes

- Heredity as the process by which genetic information is transmitted from one generation to the next.
- A simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model.

- Differences between species.
- The variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation.
- The variation between species and between individuals of the same species meaning some organisms compete more successfully, which can drive natural selection.
- Changes in the environment which may leave individuals within a species, and some entire species, less well adapted to compete successfully and reproduce, which in turn may lead to extinction.
- The importance of maintaining biodiversity and the use of gene banks to preserve hereditary material.

Chemistry

The particulate Nature of Matter

- The properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure.
- Changes of state in terms of the particle model.

Atoms, Elements and Compounds

- A simple (Dalton) atomic model.
- Differences between atoms, elements and compounds.
- Chemical symbols and formulae for elements and compounds.
- Conservation of mass changes of state and chemical reactions.

Pure and Impure Substances

- The concept of a pure substance.
- Mixtures, including dissolving.
- Diffusion in terms of the particle model.
- Simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography.
- The identification of pure substances.

Chemical Reactions

- Chemical reactions as the rearrangement of atoms.
- Representing chemical reactions using formulae and using equations.
- Combustion, thermal decomposition, oxidation and displacement reactions.
- Defining acids and alkalis in terms of neutralisation reactions.
- The pH scale for measuring acidity/alkalinity; and indicators.
- Reactions of acids with metals to produce a salt plus hydrogen.
- Reactions of acids with alkalis to produce a salt plus water.
- What catalysts do.

Energetics

- Energy changes on changes of state (qualitative).
- Exothermic and endothermic chemical reactions (qualitative).

The Periodic Table

- The varying physical and chemical properties of different elements.
- The principles underpinning the Mendeleev periodic table.
- The periodic table: periods and groups; metals and non-metals.
- How patterns in reactions can be predicted with reference to the Periodic Table.
- The properties of metals and non-metals.
- The chemical properties of metal and non-metal oxides with respect to acidity.

Materials

- The order of metals and carbon in the reactivity series.
- The use of carbon in obtaining metals from metal oxides.
- Properties of ceramics, polymers and composites (qualitative).

Earth and Atmosphere

- The composition of the Earth.
- The structure of the Earth.
- The rock cycle and the formation of igneous, sedimentary and metamorphic rocks.
- Earth as a source of limited resources and the efficacy of recycling.
- The composition of the atmosphere.
- The production of carbon dioxide by human activity and the impact on climate.

Physics

Energy

Calculation of Fuel Uses and Costs in the Domestic Context

- Comparing energy values of different foods (from labels) (kJ).
- Comparing power ratings of appliances in watts (W, kW).
- Comparing amounts of energy transferred (J, kJ, kW hour).
- Domestic fuel bills, fuel use and costs.
- fuels and energy resources

Energy Changes and Transfers

- Simple machines give bigger force but at the expense of smaller movement (and vice versa): product of force and displacement unchanged.
- Heating and thermal equilibrium: temperature difference between 2 objects leading to energy transfer from the hotter to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference; use of insulators.
- Other processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels.

Changes in Systems

- Energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change.
- Comparing the starting with the final conditions of a system and describing increases and decreases in the amounts of energy associated with movements, temperatures, changes in positions in a field, in elastic distortions and in chemical compositions.
- Using physical processes and mechanisms, rather than energy, to explain the intermediate steps that bring about such changes.

Motion and Forces

Describing Motion

- Speed and the quantitative relationship between average speed, distance and time (speed = distance ÷ time).
- The representation of a journey on a distance-time graph.
- Relative motion: trains and cars passing one another.

Forces

- Forces as pushes or pulls, arising from the interaction between 2 objects.
- Using force arrows in diagrams, adding forces in 1 dimension, balanced and unbalanced forces.
- Moment as the turning effect of a force.
- Forces: associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way; resistance to motion of air and water.
- Forces measured in newtons, measurements of stretch or compression as force is changed.
- Force-extension linear relation; Hooke's Law as a special case.
- Work done and energy changes on deformation.
- Non-contact forces: gravity forces acting at a distance on Earth and in space, forces between magnets, and forces due to static electricity.

Pressure in Fluids

- Atmospheric pressure decreases with increase of height as weight of air above decreases with height.
- Pressure in liquids, increasing with depth; upthrust effects, floating and sinking.
- Pressure measured by ratio of force over area – acting normal to any surface.

Balanced Forces

- Opposing forces and equilibrium: weight held by stretched spring or supported on a compressed surface.

Forces and Motion

- Forces being needed to cause objects to stop or start moving, or to change their speed or direction of motion (qualitative only).
- Change depending on direction of force and its size.

Waves

Observed Waves

- waves on water as undulations which travel through water with transverse motion; these waves can be reflected and add or cancel – superposition.

Sound Waves

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

Energy and Waves

- Pressure waves transferring energy; use for cleaning and physiotherapy by ultrasound; waves transferring information for conversion to electrical signals by microphone.

Light Waves

- The similarities and differences between light waves and waves in matter.
- Light waves travelling through a vacuum; speed of light.
- The transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface.

- Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing (qualitative); the human eye.
- Light transferring energy from source to absorber, leading to chemical and electrical effects; photosensitive material in the retina and in cameras.
- Colours and the different frequencies of light, white light and prisms (qualitative only); differential colour effects in absorption and diffuse reflection.

Electricity and Electromagnetism

Current Electricity

- Electric current, measured in amperes, in circuits, series and parallel circuits, currents add where branches meet and current as flow of charge.
- Potential difference, measured in volts, battery and bulb ratings; resistance, measured in ohms, as the ratio of potential difference (p.d.) to current.
- Differences in resistance between conducting and insulating components (quantitative).

Static Electricity

- Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects
- The idea of electric field, forces acting across the space between objects not in contact

Magnetism

- Magnetic poles, attraction and repulsion.
- Magnetic fields by plotting with compass, representation by field lines.
- Earth's magnetism, compass and navigation.
- The magnetic effect of a current, electromagnets, DC motors (principles only).

Matter

Physical Changes

- Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving.
- Similarities and differences, including density differences, between solids, liquids and gases.
- Brownian motion in gases.

- Diffusion in liquids and gases driven by differences in concentration.
- The difference between chemical and physical changes.

Particle model

- The differences in arrangements, in motion and in closeness of particles explaining changes of state, shape and density; the anomaly of ice-water transition.
- Atoms and molecules as particles.

Energy in Matter

- Changes with temperature in motion and spacing of particles.
- Internal energy stored in materials.

Space Physics

- Gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and sun (qualitative only).
- Our sun as a star, other stars in our galaxy, other galaxies.
- The seasons and the Earth's tilt, day length at different times of year, in different hemispheres.
- The light year as a unit of astronomical distance.

Key Stage 4

Science is a compulsory GCSE subject - GCSE Combined Science (Trilogy) 8464

Learning Intentions
General • 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 scientific enquiries that help them to answer scientific questions about the world around them. • Develop and learn to apply observational, practical, modelling, enquiry and problem-solving skills, both in the laboratory, in the field and in other learning environments. • Develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively. **Working Scientifically** *The Development of Scientific Thinking* • The ways in which scientific methods and theories develop over time. • Using a variety of concepts and models to develop scientific explanations and understanding. • Appreciating the power and limitations of science and considering ethical issues which may arise. • Explaining everyday and technological applications of science; evaluating associated personal, social, economic and environmental implications; and making decisions based on the evaluation of evidence and arguments. • Evaluating risks both in practical science and the wider societal context, including perception of risk. • Recognising the importance of peer review of results and of communication of results to a range of audiences. *Experimental Skills and Strategies* • Using scientific theories and explanations to develop hypotheses. • Planning experiments to make observations, test hypotheses or explore phenomena.

- Applying a knowledge of a range of techniques, apparatus, and materials to select those appropriate both for fieldwork and for experiments.
- Carrying out experiments appropriately, having due regard to the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations.
- Recognising when to apply a knowledge of sampling techniques to ensure any samples collected are representative.
- Making and recording observations and measurements using a range of apparatus and methods.
- Evaluating methods and suggesting possible improvements and further investigations.

Analysis and Evaluation

- applying the cycle of collecting, presenting and analysing data, including:
  Presenting observations and other data using appropriate methods.
  Translating data from one form to another.
  Carrying out and representing mathematical and statistical analysis.
  Representing distributions of results and making estimations of uncertainty.
  Interpreting observations and other data, including identifying patterns and trends, making inferences and drawing conclusions.
  Presenting reasoned explanations, including relating data to hypotheses.
  Being objective, evaluating data in terms of accuracy, precision, repeatability and reproducibility and identifying potential sources of random and systematic error.
- Communicating the scientific rationale for investigations, including the methods used, the findings and reasoned conclusions, using paper-based and electronic reports and presentations.

Vocabulary, Units, Symbols and Nomenclature

- Developing their use of scientific vocabulary and nomenclature.
- Recognising the importance of scientific quantities and understanding how they are determined.
- Using SI units and IUPAC chemical nomenclature unless inappropriate.
- Using prefixes and powers of ten for orders of magnitude (e.g. tera, giga, mega, kilo, centi, milli, micro and nano).
- Interconverting units.
- Using an appropriate number of significant figures in calculations.

Biology

Cell Biology

- Cells as the basic structural unit of all organisms; adaptations of cells related to their functions; the main sub-cellular structures of eukaryotic and prokaryotic cells.
- Stem cells in animals and meristems in plants.
- Enzymes.
- Factors affecting the rate of enzymatic reactions.
- The importance of cellular respiration; the processes of aerobic and anaerobic respiration.
- Carbohydrates, proteins, nucleic acids and lipids as key biological molecules.

Transport Systems

- The need for transport systems in multicellular organisms, including plants.
- The relationship between the structure and functions of the human circulatory system.

Health, Disease and the Development of Medicines

- The relationship between health and disease.
- Communicable diseases including sexually transmitted infections in humans (including HIV/AIDs).
- Non-communicable diseases.
- Bacteria, viruses and fungi as pathogens in animals and plants.
- Body defences against pathogens and the role of the immune system against disease.
- Reducing and preventing the spread of infectious diseases in animals and plants.
- The process of discovery and development of new medicines.
- The impact of lifestyle factors on the incidence of non-communicable diseases.

Coordination and Control

- Principles of nervous coordination and control in humans.
- The relationship between the structure and function of the human nervous system.
- The relationship between structure and function in a reflex arc.
- Principles of hormonal coordination and control in humans.
- Hormones in human reproduction, hormonal and non-hormonal methods of contraception.
- Homeostasis.

Photosynthesis

- Photosynthesis as the key process for food production and therefore biomass for life.
- The process of photosynthesis.
- Factors affecting the rate of photosynthesis.

Ecosystems

- Levels of organisation within an ecosystem.
- Some abiotic and biotic factors which affect communities; the importance of interactions between organisms in a community.
- How materials cycle through abiotic and biotic components of ecosystems.
- The role of microorganisms (decomposers) in the cycling of materials through an ecosystem.
- Organisms are interdependent and are adapted to their environment.
- The importance of biodiversity.
- Methods of identifying species and measuring distribution, frequency and abundance of species within a habitat.
- Positive and negative human interactions with ecosystems.

Evolution, Inheritance and Variation

- The genome as the entire genetic material of an organism.
- How the genome, and its interaction with the environment, influence the development of the phenotype of an organism.
- The potential impact of genomics on medicine.
- Most phenotypic features being the result of multiple, rather than single, genes.

- Single gene inheritance and single gene crosses with dominant and recessive phenotypes.
- Sex determination in humans.
- Genetic variation in populations of a species.
- The process of natural selection leading to evolution.
- The evidence for evolution.
- Developments in biology affecting classification.
- The importance of selective breeding of plants and animals in agriculture.
- The uses of modern biotechnology including gene technology; some of the practical and ethical considerations of modern biotechnology.

Chemistry

Atomic Structure and the Periodic Table

- A simple model of the atom consisting of the nucleus and electrons, relative atomic mass, electronic charge and isotopes.
- The number of particles in a given mass of a substance.
- The modern Periodic Table, showing elements arranged in order of atomic number.
- Position of elements in the Periodic Table in relation to their atomic structure and arrangement of outer electrons.
- Properties and trends in properties of elements in the same group.
- Characteristic properties of metals and non-metals.
- Chemical reactivity of elements in relation to their position in the Periodic Table.

Structure, Bonding and the Properties of Matter

- Changes of state of matter in terms of particle kinetics, energy transfers and the relative strength of chemical bonds and intermolecular forces.
- Types of chemical bonding: ionic, covalent, and metallic.
- Bulk properties of materials related to bonding and intermolecular forces.
- Bonding of carbon leading to the vast array of natural and synthetic organic compounds that occur due to the ability of carbon to form families of similar compounds, chains and rings.
- Structures, bonding and properties of diamond, graphite, fullerenes and graphene.

Chemical Changes

- Determination of empirical formulae from the ratio of atoms of different kinds.
- Balanced chemical equations, ionic equations and state symbols.
- Identification of common gases.
- The chemistry of acids; reactions with some metals and carbonates.
- pH as a measure of hydrogen ion concentration and its numerical scale.
- Electrolysis of molten ionic liquids and aqueous ionic solutions.
- Reduction and oxidation in terms of loss or gain of oxygen.

Energy Changes in Chemistry

- Measurement of energy changes in chemical reactions (qualitative).
- Bond breaking, bond making, activation energy and reaction profiles (qualitative).

Rate and Extent of Chemical Change

- Factors that influence the rate of reaction: varying temperature or concentration, changing the surface area of a solid reactant or by adding a catalyst.
- Factors affecting reversible reactions.

Chemical analysis

- Distinguishing between pure and impure substances.
- Separation techniques for mixtures of substances: filtration, crystallisation, chromatography, simple and fractional distillation.
- Quantitative interpretation of balanced equations.
- Concentrations of solutions in relation to mass of solute and volume of solvent.

Chemical and Allied Industries

- Life cycle assessment and recycling to assess environmental impacts associated with all the stages of a product's life.
- The viability of recycling of certain materials.
- Carbon compounds, both as fuels and feedstock, and the competing demands for limited resources.

- Fractional distillation of crude oil and cracking to make more useful materials.
- Extraction and purification of metals related to the position of carbon in a reactivity series.

Earth and Atmospheric Science

- Evidence for composition and evolution of the Earth's atmosphere since its formation.
- Evidence, and uncertainties in evidence, for additional anthropogenic causes of climate change.
- Potential effects of, and mitigation of, increased levels of carbon dioxide and methane on the Earth's climate.
- Common atmospheric pollutants: sulphur dioxide, oxides of nitrogen, particulates and their sources.
- The Earth's water resources and obtaining potable water.

Physics

Energy

- Energy changes in a system involving heating, doing work using forces, or doing work using an electric current: calculating the stored energies and energy changes involved.
- Power as the rate of transfer of energy.
- Conservation of energy in a closed system, dissipation.
- Calculating energy efficiency for any energy transfers.
- Renewable and non-renewable energy sources used on Earth, changes in how these are used.

Forces

- Forces and fields: electrostatic, magnetic, gravity.
- Forces as vectors.
- Calculating work done as force x distance; elastic and inelastic stretching.
- Pressure in fluids acts in all directions: variation in Earth's atmosphere with height, with depth for liquids, up-thrust force (qualitative).

Forces and Motion

- Speed of sound, estimating speeds and accelerations in everyday contexts.
- Interpreting quantitatively graphs of distance, time, and speed.
- Acceleration caused by forces; Newton's First Law.
- Weight and gravitational field strength.
- Decelerations and braking distances involved on roads, safety.

Wave Motion

- Amplitude, wavelength, frequency, relating velocity to frequency and wavelength.
- Transverse and longitudinal waves.
- Electromagnetic waves, velocity in vacuum; waves transferring energy; wavelengths and frequencies from radio to gamma-rays.
- Velocities differing between media: absorption, reflection, refraction effects.
- Production and detection, by electrical circuits, or by changes in atoms and nuclei.
- Uses in the radio, microwave, infra-red, visible, ultra-violet, X-ray and gamma-ray regions, hazardous effects on bodily tissues.

Electricity

- Measuring resistance using p.d. and current measurements.
- Exploring current, resistance and voltage relationships for different circuit elements; including their graphical representations.
- Quantity of charge flowing as the product of current and time.
- Drawing circuit diagrams; exploring equivalent resistance for resistors in series.
- The domestic a.c. supply; live, neutral and earth mains wires, safety measures.
- Power transfer related to p.d. and current, or current and resistance.

Magnetism and Electromagnetism

- Exploring the magnetic fields of permanent and induced magnets, and the Earth's magnetic field, using a compass.
- Magnetic effects of currents, how solenoids enhance the effect.
- How transformers are used in the national grid and the reasons for their use.
- The structure of matter.

- Relating models of arrangements and motions of the molecules in solid, liquid and gas phases to their densities.
- Melting, evaporation, and sublimation as reversible changes.
- Calculating energy changes involved on heating, using specific heat capacity; and those involved in changes of state, using specific latent heat.
- Links between pressure and temperature of a gas at constant volume, related to the motion of its particles (qualitative).

Atomic Structure

- The nuclear model and its development in the light of changing evidence.
- Masses and sizes of nuclei, atoms and small molecules.
- Differences in numbers of protons, and neutrons related to masses and identities of nuclei, isotope characteristics and equations to represent changes.
- Ionisation; absorption or emission of radiation related to changes in electron orbits.
- Radioactive nuclei: emission of alpha or beta particles, neutrons, or gamma-rays, related to changes in the nuclear mass and/or charge.
- Radioactive materials, half-life, irradiation, contamination and their associated hazardous effects, waste disposal.
- Nuclear fission, nuclear fusion and our sun's energy.

Space Physics

- The main features of the solar system.

Curriculum Assessment

Key Stage 3 Indicative Competencies

Grade	Key Terms, Concepts and Processes	Planning to Collect Evidence	Collecting and Recording Evidence	Presenting Evidence – Graphs	Considering Evidence
9	Can comprehensively recall, define and explain key terms, concepts and processes and make clear links between them.	Consider a range of approaches to the investigation, making a decision based on scientific knowledge and understanding.	Make decisions about obtaining precise, accurate and reliable data.	As for grade 8 but also independently and confidently: Identify and explain points of particular significance.	Independently and confidently: Discuss how certain you can be of the evidence you have produced.
8	Can confidently recall, define and explain key terms, concepts and processes and make links between them.	Discuss in detail your investigation.	On your own, make systematic, precise and reliable observations and measurements.	Decide on suitable complex scales for your graph and plot sufficient points on the graph with an accurate line of best fit.	Independently, begin to explain and allow for anomalies.
7	Can effectively recall, define and explain key terms, concepts and processes.	Plan to collect data that is reliable.	On your own, make a series of precise and reliable observations/measurements.	Include averages where appropriate and plot at least five points on your graph. Draw an accurate line or curve of best fit.	Describe the relationship between the variables quantitatively. Identify any anomalies in your results.
6	Can recall, define and explain key terms, concepts and processes.	As for grade 5, but plan to collect repeat measurements.	Make a series of precise observations or measurements systematically.	Plot the points on your graph. Attempt to draw a line or curve of best fit.	Make and explain your conclusion consistent with your evidence.
5	Can recall define and explain most key terms, concepts and processes.	State the range of measurements you will make.	Make a series of observations/measurements.	Design a simple results table to record your evidence clearly.	Explain your conclusion using scientific words.
4	Can recall, define and explain some key terms, concepts and processes.	Describe what you are trying to find out, including an equipment list and a regard for safety, including variables.	Make at least three observations/measurements.	With help, record data in a simple table, draw simple bar charts with scales and plot a simple graph.	With help, explain your conclusion using simple vocabulary.
3	Can recall some key terms, concepts and processes with limited definitions and explanations.	Suggest what you are trying to find out and how you are going to make it a fair test.	With some help, take three observations or measurements.	With some help, plot a simple bar chart.	With some help, state your conclusion.
2	Can recall some key terms, concepts and processes.	Simply state what and how you are trying to find out.	Follow simple instructions.	With help, draw a suitable table for collected results.	With help, state a pattern in your results.
1	Can recall a very limited number of key terms, concepts and processes.	Simply state what you are trying to find out.	Be safe when instructed.	With help, collect some results to put in a simple table.	With help, state what your results show.

Key Stage 4 GCSE Scheme of Assessment

AQA GCSE Combined Science (Trilogy) Scheme of Assessment

Curriculum Overview

Key Stage 3

Year Group	Autumn Term	Spring Term	Summer Term
7	• Introduction to Science • Forces (speed and gravity) • Matter (particle model and separating mixtures)	• Organisms (movement and cells) • Electromagnets (voltage, resistance and current)	• Reactions (metals/non-metals and acids/alkalis) • Ecosystems – Interdependence and Plant Reproduction
8	• Energy – Energy Costs and Energy Transfer • Earth – Earth Structure and Universe • Genes – Variation and Human Reproduction	• Waves (sounds and light) • Organisms– Breathing and Digestion, Reproduction	• Matter – Periodic Table and elements Forces – Contact Forces and Pressure
9	• Electromagnets – Magnetism and Electromagnetism • C Reactions – Chemical Energy and Types of Reaction • Ecosystems – Respiration and Photosynthesis	• Energy – Work and Heating and Cooling • Earth – Climate and Earth Resources	• Genes – Evolution and Inheritance • Waves – Wave Effects and Wave Properties • Science Lab Practicals

Key Stage 4

Year Group	Autumn Term	Spring Term	Summer Term
10	**Physics 1** • Energy • Electricity • Particle Model of Matter • Atomic Structure	**Chemistry 1** • Atomic Structure and the Periodic Table • Bonding, Structure and Properties of Matter • Quantitative Chemistry • Chemical Changes • Energy Changes	**Biology 1** • Cell Biology • Organisation • Infection and Response • Bioenergetics
11	**Physics 2** • Forces • Waves • Magnetism and Electromagnetism	**Chemistry 2** • The Rate and Extent of Chemical Change • Organic Chemistry • Chemical Analysis • Chemistry of the Atmosphere • Using Resources	**Biology 2** • Homeostasis and Response • Inheritance, Variation and Evolution • Ecology

Curriculum Content

Year 7

Topic	**Forces *(Speed and Gravity)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Forces *(Speed and Gravity)*.						
Lesson Learning Intentions	1. The greater the speed, the shorter the time taken to cover a certain distance. • An object's motion can be represented on a distance–time graph, which can be analysed to find out more about the motion. • A straight line on a distance–time graph shows constant speed, and a curved line shows acceleration. • The motion of two objects can be compared and their relative speeds calculated. 2. All the forces acting on an object can be combined to find the resultant – a single force which has the same effect. 3. Mass and weight are different, but related. • Gravity is a non-contact force that acts between all masses. • Every object exerts a gravitational pull on every other object. • A planet, like the Earth, has a gravitational field. • The gravitational fields of the Earth and other objects in the solar system affect space travel.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work				✓		

	• Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work						
Resources	https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zw9qwnb https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zr3xh39		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Speed; average speed; relative motion; acceleration; weight; non-contact force; mass; gravitational field strength; field.			✓			
Numeracy	Use the formula: speed = distance (m)/time (s) or distance-time graphs, to calculate speed. Use the formula: weight (N) = mass (kg) x gravitational field strength (N/kg). g on Earth = 10 N/kg. On the moon it is 1.6 N/kg.			✓			
Challenge	Can sound travel is space? Justify this question.	✓					✓

Topic	**Particle model and Separating mixtures**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Particle model and Separating mixtures.						
Lesson Learning Intentions	1) The particle model explains why solids have a fixed shape and cannot flow, and why liquids and gases do not have a fixed shape and can flow. • Particles in solids, liquids and gases have their own internal energy – the energy of particles in a gas is far higher than the energy of particles in liquids and solids. • The effect of temperature can be explained using the particle model. This explains how changes of state take place and how solids, liquids and gases expand on heating. • We can also explain differences in density, concentration and pressure using the particle model. These differences can account for why perfume spreads in a room. 2) If solid material has been mixed with water but has not dissolved, we can separate it by using a filter or a sieve.				✓	✓	✓

	• If we heat a liquid it will evaporate, turning into a vapour (gas). If we then cool the vapour, it will turn back into a liquid. This process is called distillation. • We can use information about different boiling points to separate mixtures of liquids. Distillation is used to make perfume and fuels such as petrol. • Soluble substances can be made to travel up filter paper by adding a solvent. • If we do this with coloured dyes or inks, we find that the different colours in the mixture move different distances. • This technique is called paper chromatography and can be used to separate mixtures and identify chemicals.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	https://www.bbc.co.uk/bitesize/topics/z9r4jxs https://www.bbc.co.uk/bitesize/guides/zb2f3k7/revision/2		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Particle; particle model; diffusion; gas pressure; density; evaporate; boil; condense; melt; freeze; sublime; solvent; solute ; dissolve; solution; soluble (insoluble); solubility; pure substance; mixture; filtration; distillation; chromatography.			✓			
Numeracy	Calculate density of objects using equation: density = mass ÷ volume Calculate Rf value using equation: distance travelled by substance ÷ distance travelled by solvent Determine the melting and boiling points of substances from a given graph			✓			
Challenge	Why can some materials/substances have properties of both a liquid and a solid?	✓					✓

Topic	**Organisms *(Movement and Cells)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Organisms *(Movement and Cells).*						

Lesson Learning Intentions	1) The skeleton allows movement at the joints. • The skeleton also protects some organs. • Most blood cells are made inside bones (bone marrow). 2) Muscles contract to move bones at the joints. • Muscles can only contract and relax – they cannot push. • Many muscles interact and work in pairs to bring about opposite movements. 3) Cells are the building blocks of life. They contain structures called organelles, which all have specific jobs. • Microscopes can be used to observe cells and other structures. • Some organisms, such as bacteria and protozoa, consist of only a single cell. They can, nevertheless, carry out all necessary life processes. 4) A human body has a highly organised set of organ systems, organs, tissues and cells. • Many cells, such as muscle cells and nerve cells, are specialised, enabling them to carry out a specific task more effectively. • Body systems can be affected by certain drugs and by damage to other organs.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	https://www.bbc.co.uk/bitesize/topics/znyycdm https://www.bbc.co.uk/bitesize/guides/zsgfv4j/revision/1		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Cell, tissue, organ, muscle, skeleton, joint, digestion, enzyme, respiration, magnification, slide, cover slip, microscope, vacuole, membrane, nucleus, cell wall, chlorophyll, cytoplasm			✓			
Numeracy	Calculating magnification			✓			
Challenge	Produce a model of a cell, using household items.	✓					✓

Topic	**Electromagnets *(Voltage, Resistance and Current)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Electromagnets *(Voltage, Resistance and Current)*						
Lesson Learning Intentions	1) Components in an electric circuit provide opposition to the current, known as resistance, and transfer energy to the surroundings. • Components in circuits can be arranged in series or in parallel. These arrangements have different effects on the voltage and current, and provide different applications. • The current, voltage and resistance are related to each other. • Models are a good way of explaining what happens in a circuit. 2) Current is a movement of electrons and is the same everywhere in a series circuit. • Current depends on the 'push' given by the battery, known as the voltage. • Current divides between loops in a parallel circuit and combines when loops meet. 3) Voltage, or 'potential difference', is the amount of energy per unit of charge transferred through the electrical pathway. • In a series circuit, voltage is shared between each component. In a parallel circuit, voltage is the same across each loop. 4) Around a charged object, the electric field affects other charged objects, causing them to be attracted or repelled. • The field strength decreases with distance.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	https://www.bbc.co.uk/bitesize/topics/zgy39j6/articles/z6n27yc		✓		✓		✓

	https://www.bbc.co.uk/bitesize/topics/zrvbkqt https://www.bbc.co.uk/bitesize/topics/zgy39j6						
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Potential difference (voltage); resistance; electrical conductor; electrical insulator; electrons; electrostatic force; current; series; parallel; field; electomagnet; solenoid; core;			✓			
Numeracy	Calculate potential difference, current and resistance.			✓			
Challenge	Why is copper such a good conductor of heat and electricity?	✓					✓

Topic	Reactions *(Metals and non-metals and Acids and alkalis)*	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Reactions *(Metals and non-metals and Acids and alkalis).*						
Lesson Learning Intentions	1) Most metals are solid and strong. • Alloys often have different properties from their component metals, giving them different uses. • Many non-metals are unreactive gases at room temperature. • Some metals and non-metals have unusual properties, for example mercury and bromine. 2) We can represent reactions using equations and particle diagrams. • Many metals react with acids to produce a salt plus hydrogen gas. • Oxidation is a reaction with oxygen to form an oxide compound. Combustion and rusting are examples of oxidation. • More reactive elements will remove less reactive elements from their compounds. This is known as displacement. We can use displacement reactions to predict a reactivity series. • The reactivity series is a list of elements (mainly metals) arranged in order of their reactivity. 3) We use acids in our everyday lives, for example in food and batteries. • We use alkalis in our everyday lives, for example in cleaning products and medicines. • Some acids and alkalis are hazardous. • We can make and use indicators to show how acidic or alkaline a substance is. • The pH scale is an important measure of the level of acidity and alkalinity of a substance. 4) Acids react with metals and with alkalis. • In these reactions the particles are rearranged – we can show this using diagrams, equations and other models.				✓	✓	✓

	• A neutral substance is one with pH 7. It is made when an acid and an alkali exactly neutralise one another. • Neutralisation reactions can be useful for our health.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	https://www.bbc.co.uk/bitesize/topics/zypsgk7 https://www.bbc.co.uk/bitesize/topics/zv9nhcw/articles/z8qrr2p https://www.bbc.co.uk/bitesize/topics/zn6hvcw		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Metals ; non-metals ; displacement ; oxidation ; reactivity ; pH ; indicators ; base ; concentration			✓			
Numeracy	Application of the pH scale			✓			
Challenge	Testing acidic/alkaline household items	✓					✓

Topic	Ecosystems *(Interdependence and Plant reproduction)*	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Ecosystems *(Interdependence and Plant reproduction)*.						
Lesson Learning Intentions	1) In any environment there are many interlinked food chains. These can be disrupted by factors such as toxins entering the food chain, or disease. • Food chains usually start with a plant or plant material, called a producer. • Animals that eat plants and other animals are consumers and these are found at different levels of a food chain. • The availability of food is crucial, and insects can play an important role in food security. 2) Flowers are adapted in many ways to attract pollinators or use the wind to help pollination. • A pollen grain contains the male sex cell in plant reproduction and the ovule is the female sex cell; fertilisation is the meeting of these two cells. • Plants have evolved different mechanisms to disperse their seeds, increasing their chances of survival. • We can use models to investigate the efficiency of seed dispersal.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	https://www.bbc.co.uk/bitesize/topics/zxhhvcw https://www.bbc.co.uk/bitesize/topics/zybbkqt		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				

Literacy	Ovule, pollination, fertilisation, producer, toxins.			✓			
Numeracy	Constructing and analysing food chains and pyramids of biomass.			✓			
Challenge	Explain why certain animals play a critical role in seed dispersal.	✓					✓

Topic	**Energy *(Energy costs and Energy transfer)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Energy *(Energy costs and Energy transfer)*						
Lesson Learning Intentions	1) Energy is transferred when changes happen, and this transfer can happen in many different ways. • An object stores energy if it has been raised up. This is because it is affected by the Earth's gravitational force. • When elastic materials are stretched or squashed they have more energy stored in them. 2) Fuels are energy stored chemically. They include wood, fossil fuels and hydrogen. • Fuels only burn if oxygen is present. The products of burning also store energy, but less than that in the fuel and oxygen. • When a fuel is burned in oxygen, energy is transferred to the surroundings. 3) The quantity of energy transferred in a change can be measured. • How quickly energy is transferred is the power and this can also be measured. • Electricity is generated by using different energy resources, which each have advantages and disadvantages. • We pay for our domestic electricity based on the amount of energy transferred. • We can calculate the cost of home energy usage using the formula: cost = power (kW) × time (hours) × price (per kWh). 4) We can describe how jobs get done using an energy model where energy is transferred from one store at the start to another store at the end. • When energy is transferred, the energy total is conserved, but some energy is dissipated, reducing the useful energy.				✓	✓	✓

Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	https://www.bbc.co.uk/bitesize/topics/zc3g87h https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zvg7jsg		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Conserved, dissipated, domestic, elastic, gravitational			✓			
Numeracy	Calculate the cost of home energy usage using the formula: cost = power (kW) × time (hours) × price (per kWh)			✓			
Challenge	Where does energy come from?	✓					✓

Year 8

Topic	**Earth *(Earth structure and Universe)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Earth *(Earth structure and Universe)*.						
Lesson Learning Intentions	1) Sedimentary, igneous and metamorphic rocks can be inter-converted over millions of years, through weathering and erosion, heat and pressure, and melting and cooling. • Magma from volcanoes solidifies to form igneous rock. • There is a relationship between the shape of a volcano and the type of magma it produces. • There are different ways that fossils can form in sedimentary rock. • Rocks are continually being broken down and new rocks are formed. This is described by the rock cycle. • The constant movement of the Earth's crust causes rocks deep underground to be brought to the surface and mountain ranges to form. 2) Distances in space are so vast that special units are used to measure them. • Our solar system is a tiny part of a galaxy, one of many billions of galaxies in the Universe. • Light takes minutes to reach Earth from the Sun, four years from our nearest star and billions of years from other galaxies. 3) The solar system can be modelled as planets rotating on tilted axes while orbiting the Sun, moons orbiting planets, and sunlight spreading out and being reflected. • This explains day and year length, the seasons, and how we see objects from Earth.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction				✓		

	• Calculation work						
Resources	https://www.bbc.co.uk/bitesize/topics/z3fv4wx/articles/z9qpsk7 https://www.bbc.co.uk/bitesize/topics/z8c9q6f		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Sedimentary, igneous, metamorphic, magma			✓			
Numeracy	Understanding of the term 'light year'.			✓			
Challenge	Making a model solar system.	✓					✓

Topic	**Genes *(Variation and Human reproduction)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Genes *(Variation and Human reproduction)*.						
Lesson Learning Intentions	1) There is variation within a species, and this can be measured and classified as continuous or discontinuous variation. • Variations can be caused by the environment or by inheritance, but many are caused by a combination of both factors. • Variation between organisms ensures that some organisms survive. • Species that have too little variation may become extinct. 2) The male and female human reproductive systems are adapted for successful reproduction. • Puberty and reproduction are controlled by hormones. Drugs can be used to support infertility and contraception. • When an egg is fertilised, it develops into a foetus. This grows in the uterus until it becomes a fully grown baby. • Many factors affect the growth and development of a foetus, including the mother's use of alcohol, cigarettes and drugs.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		

Resources	https://www.bbc.co.uk/bitesize/topics/zpffr82/articles/z6j66g8?course=zwph6g8 https://www.bbc.co.uk/bitesize/topics/zybbkqt		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Quadrats, transects, decomposers, producer, predator, prey, primary consumer, secondary consumer, tertiary consumer, abiotic, biotic, adaptation, ecosystem, community, habitat			✓			
Numeracy	Constructing charts/graphs to represent continuous and discontinuous data.			✓			
Challenge	Name and give the function(s) of hormones involved in puberty and reproduction.	✓					✓

Topic	**Waves (Sound and Light)**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Waves (Sound and Light).						
Lesson Learning Intentions	1) Energy is transferred by sound in the form of waves. • Sound travels as longitudinal waves (vibrations) passed on by particles of a material. • Sounds can be represented by waveforms, showing wavelength, frequency and amplitude. • The greater the amplitude of the waveform, the louder the sound. • The greater the frequency (and the shorter the wavelength), the higher the pitch. • The ear is a detector of sound waves of a certain frequency range. 2) The denser the medium, the faster sound travels. • Sound is transmitted, reflected or absorbed by different types of surface. • Echoes occur when sound waves are reflected by hard materials. 3) Light travels as transverse waves that carry energy. • White light can be split into a spectrum of colours. • Coloured light causes an object to appear a different colour. 4) Light waves can travel through a vacuum. • Light can be reflected, absorbed and refracted. • When it is reflected, the angle of incidence equals the angle of reflection. Light can form an image in a mirror. • Light can be refracted through lenses and prisms. • Wave properties can be described using a ray diagram as a model.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response)				✓		

	• Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work						
Resources	https://www.bbc.co.uk/bitesize/topics/zw982hv https://www.bbc.co.uk/bitesize/topics/zw982hv/articles/zpm3r2p https://www.bbc.co.uk/bitesize/topics/zw982hv/articles/zryrkhv		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Energy, particle, frequency, amplitude, wavelength, longitudinal, reflected, absorbed, refracted, prism, vacuum			✓			
Numeracy	Calculating: frequency, amplitude, and velocity of waves Determine angle of reflection using a protractor			✓			
Challenge	How do fibre optic cables carry information? (e.g. Fibre optic broadband).	✓					✓

Topic	**Forces *(Contact forces and Pressure)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Forces (Contact forces and Pressure).						
Lesson Learning Intentions	1) Elastic materials behave in a special way when forces such as tension or compression change their shape. • Materials can become permanently deformed when they are stretched or compressed by large forces. • Stresses on a solid can explain effects such as the scratching of a surface, sinking or breakage. 2) Friction is caused by one surface moving over another.				✓	✓	✓

	• If one of the surfaces is a fluid, it is called 'drag'. 3) Pressure is the force acting on a certain area. • Pressure can act in solids, liquids and gases. • An upthrust force affects all objects that are submerged in a liquid. • Pressure in a fluid increases with depth. • The volume of an object affects the amount of upthrust it experiences in a liquid. 4) A force on a moving object may cause its speed to increase or decrease. • If opposing forces act on an object and are balanced the object is in equilibrium.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zs3896f https://www.bbc.co.uk/bitesize/topics/z4brd2p/articles/zvdpf82		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Tension, compression, fluid, drag, pressure, equilibrium.			✓			
Numeracy	Calculating resultant force. Calculating pressure using equation: pressure = force ÷ area.			✓			
Challenge	Explain why camels have large feet.	✓					✓

Topic	Periodic table and Elements	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of The Periodic Table and Elements.						
Lesson Learning Intentions	1) The chemist's dictionary is called the periodic table. • The ingredients of the entire Universe are listed in one place. 2) Atoms of elements combine to form compounds. These compounds have different properties to the elements they contain. • Compounds are named using chemical formulae. Chemical formulae show us which elements a compound contains and their relative proportions. 3) Chemists can represent the building blocks of all materials using simple models and symbols. • Chemical models and symbols help us understand how elements join and react together to make new materials. 4) Ceramics, polymers and composite materials have been in use for many thousands of years. Today, many new types of materials are being made, based on the chemistry of these earlier materials. These have exciting applications – such as in racing cars, rockets and modern buildings.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review				✓		

	• Graph construction • Calculation work						
Resources	https://www.bbc.co.uk/bitesize/topics/zv9nhcw https://www.bbc.co.uk/bitesize/courses/zq333j6		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Ceramic, polymer, element, compound.			✓			
Numeracy	Use and apply relative atomic mass and atomic number.			✓			
Challenge	Making a class periodic table.	✓					✓

Topic	**Organisms (Breathing and Digestion)**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Organisms (Breathing and Digestion).						
Lesson Learning Intentions	1) Breathing occurs through the action of muscles in the ribcage and diaphragm causing a change in volume of the chest. • The breathing system is well adapted to get gases in and out of our bodies. • During gas exchange, oxygen is transported to cells for aerobic respiration and carbon dioxide is removed from the body. • Disease and lifestyle can affect our breathing system, for example, asthma and smoking. 2) Each component of a healthy diet has a different role. For example, carbohydrates provide energy, fibre supports the large intestine and protein allows growth and repair. • Different foods provide different amounts of energy and different people have different energy requirements depending on age and lifestyle. • Both starvation and obesity can cause serious health issues. 3) Each part of the digestive system has a specific role. For example, protein digestion begins in the mouth, the small intestine allows absorption of nutrients and the large intestine removes water. • Each organ of the digestive system is well adapted to do its job. • Following digestion, food molecules are transported to cells for respiration. • Enzymes are biological catalysts and they digest specific food molecules to smaller molecules. • Bacteria live in the gut and some of these help us to digest food.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching				✓		

	• Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work						
Resources	https://www.bbc.co.uk/bitesize/topics/zvrrd2p/articles/zbhcg7h https://www.bbc.co.uk/bitesize/topics/zf339j6		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Diaphragm, aerobic respiration, asthma, carbohysdrates, enzymes, catalyst, bacteria.			✓			
Numeracy	Calculating the rate of enzyme activity.			✓			
Challenge	Why are enzymes added to washing powder?	✓					✓

Topic	**Electromagnets *(Magnetism and Electromagnetism)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Electromagnets (Magnetism and Electromagnetism).						
Lesson Learning Intentions	1) Magnetic materials, electromagnets and the Earth create magnetic fields which can be described by drawing field lines to show the strength and direction. 2) The stronger the magnet, and the smaller the distance from it, the greater the force a magnetic object in the field experiences. 3) A current flowing through a wire causes a magnetic field. Its strength depends on the current, the core and the number of coils in the solenoid. • When a coil of wire is placed in a magnetic field and a current is passed through it, the coil moves. This is because the coil of wire acts as a magnet itself – an electromagnet. 4) Electromagnetism is the basis of the motors used in power tools, mixers and cars. • In an electromagnet it is possible to switch the magnetic field off. Metal-recycling plants use electromagnets to separate iron and steel from aluminium.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work				✓		

	• Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work						
Resources	**Magnetism and Electromagnetism-** https://www.bbc.co.uk/bitesize/topics/zrvbkqt		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Electromagnet, current, solenoid.			✓			
Numeracy	Using a plotting compass to draw magnetic field lines around a bar magnet.			✓			
Challenge	Making a magnetic compass	✓					✓

Year 9

Topic	**Reactions *(Chemical energy and Types of reaction)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Reactions (Chemical energy and Types of reaction).						
Lesson Learning Intentions	1) Some reactions transfer energy to their surroundings – these are known as exothermic reactions. Other reactions take in energy from their surroundings – these are known as endothermic reactions. Photosynthesis is the most common endothermic reaction. • Catalysts are substances that can speed up or slow down a reaction. Enzymes are examples of biological catalysts. 2) We can control combustion by understanding what is needed for substances to burn. • Combustion changes the atmosphere because of the new products that are formed. • Air pollution from combustion can cause rain to become acidic and cause environmental problems.				✓	✓	✓

	• Thermal decomposition reactions happen when substances break down to simpler products when they are heated. 3) Chemical elements can join together in many ways to produce an amazing range of different substances. • The Law of Conservation of Mass states that mass is never lost or gained in chemical reactions.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	**Chemical reactions-** https://www.bbc.co.uk/bitesize/topics/zypsgk7		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Endothermic, Exothermic, Combustion, Catalysts, Thermal decomposition, Photosynthesis			✓			
Numeracy	Balancing equations (e.g. complete combustion). Drawing and interpreting energy profile diagrams. Apply the law of conservation of mass.			✓			
Challenge	Explain how sport injury packs work.	✓					✓

Topic	Ecosystems *(Respiration and Photosynthesis)*	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Ecosystems (Respiration and Photosynthesis).						
Lesson Learning Intentions	1) Aerobic respiration uses glucose and oxygen to release energy. • The energy released by respiration is needed for muscles to contract. • Stamina sports rely mainly on aerobic respiration 2) Anaerobic respiration occurs when you do not have enough oxygen for aerobic respiration. • Anaerobic respiration does not release as much energy as aerobic respiration. • Brewing and baking are applications of anaerobic respiration (fermentation). 3) Plants have adaptations that allow them to survive and grow, for example, stomata in the leaves. • Plants have a network of vessels that transport water and minerals to their leaves and flowers. • Healthy plants need certain essential minerals. Without these minerals they show symptoms of mineral deficiency. • The amount of photosynthesis that takes place in a plant is affected by various factors, including the levels of carbon dioxide, light, water and temperature.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work				✓		

	• Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work						
Resources	**Respiration-** https://www.bbc.co.uk/bitesize/topics/zvrrd2p **Photosynthesis-** https://www.bbc.co.uk/bitesize/topics/z7c72v4/articles/zdxkcmn		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Aerobic respiration, anaerobic respiration, fermentation, stomata, deficiency.			✓			
Numeracy	Calculating the rate of photosynthesis			✓			
Challenge	How are cacti adapted to conserve water?	✓					✓

Topic	**Energy *(Work and Heating & Cooling)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Energy (Work and Heating & Cooling).						
Lesson Learning Intentions	1) Work is done and energy transferred when a force moves an object. The bigger the force or distance, the greater the work. 2) Machines make work easier by reducing the force needed. Levers and pulleys do this by increasing the distance moved, and wheels reduce friction. • A lever works through a fulcrum to multiply a force. • By working out the size of turning forces we can make sure that structures balance. 3) The thermal energy of an object depends upon its mass, its temperature and what it's made of. • Fuels are chemicals that transfers energy by burning. • Different fuels store and transfer different amounts of energy. 4) When there is a temperature difference, energy transfers from the hotter to the cooler object. • Thermal energy is transferred through different pathways, by particles in conduction and convection, and by radiation.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work				✓		

	• Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work						
Resources	**Heating & Cooling-** https://www.bbc.co.uk/bitesize/topics/zc3g87h/articles/znw7jsg		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Force, conduction, convection, radiation, levers			✓			
Numeracy	Calculating work done using equation: work done = force x distance Read from a thermometer (alcohol and digital).			✓			
Challenge	Explain how convection works in a fridge freezer to keep food items cool.	✓					✓

Topic	**Earth *(Climate and Earth resources)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Earth (Climate and Earth resources).						
Lesson Learning Intentions	• Nature constantly recycles materials – for example, carbon in the carbon cycle. • Carbon is recycled through natural processes in the atmosphere, ecosystems (such as photosynthesis and respiration), oceans and the Earth's crust. • It is also used and changed in human activities (such as burning fuels). • The Earth's atmosphere has changed over time and is still changing now. • Some human activities are thought to affect the rate at which the atmosphere is changing. • Greenhouse gases reduce the amount of energy lost from the Earth through radiation and therefore the temperature has been rising as the concentration of those gases has risen. • Scientists have evidence that global warming caused by human activity is causing changes in climate. • There is only a certain quantity of any resource on Earth, so the faster it is extracted, the sooner it will run out. Recycling reduces the need to extract resources. • The need to use land for homes, industry and farming must be balanced against the impact on the Earth's resources. • Most metals are found combined with other elements, as a compound, in ores. • The more reactive a metal, the more difficult it is to separate it from its compound.				✓	✓	✓

	• Carbon displaces less reactive metals, while electrolysis is needed for more reactive metals.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	**Earth resources-** https://www.bbc.co.uk/bitesize/topics/z3fv4wx/articles/zsgkdp3		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Ecosystem, Atmosphere, Climate, Photosynthesis, Respiration, Ore, Electrolysis, Compound, Displacement			✓			
Numeracy	Use a pie chart to determine the % of gases in the current atmosphere. Draw pie charts/bar charts.			✓			
Challenge	Explain why some people say 'Trees are the lungs of the planet earth'	✓					✓

Topic	**Genes *(Evolution and Inheritance)***	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Genes (Evolution and Inheritance).						
Lesson Learning Intentions	• Natural selection is driven by competition for resources and variation within a species. • The theory of evolution describes how species change over time. The theory of Charles Darwin suggests that this happens by natural selection. • Biodiversity is a measure of the living things within an ecosystem. • Biodiversity can be measured by the variation within species or by the number of different species in an ecosystem. • High biodiversity is important to preserve populations and to ensure we have resources such as food, medicines and materials.				✓	✓	✓

	• Extinction occurs when no individuals of a species remain. • The extinction of dinosaurs is an example of mass extinction. There are several theories suggested for this extinction. • Gene banks are a way of preserving genetic materials of plants and animals prior to extinction. • DNA has a very complex structure. Understanding the structure of DNA allows us to understand how it determines our features. • Chromosomes and genes are portions of DNA that carry inherited information. • Wilkins, Franklin, Watson and Crick played important roles in discovering the structure of DNA. • Chromosomes from each parent are passed on during reproduction. • The features that you have are determined by the form of the genes you inherited from your parents. • Some genes can mask the effects of others. • A small change in a chromosome or gene can cause a genetic disorder. • Genetic diagrams can be used to model inheritance and to predict the probability of inheriting a specific trait.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	**Evolution-** https://www.bbc.co.uk/bitesize/topics/zpffr82/articles/z46hxbk **Inheritance-** https://www.bbc.co.uk/bitesize/topics/zpffr82		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Genes, Chromosome, Variation, Biodiversity, Species, Extinction, Trait			✓			
Numeracy	Completing genetic cross diagrams/punnet squares and determining probability			✓			
Challenge	Making a family tree	✓					✓

Topic	Waves *(Wave effects and Wave properties)*	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of Waves (Wave effects and Wave properties).						
Lesson Learning Intentions	• Living cells can be damaged by light and other waves, depending on their frequency. • Audio equipment converts sound into a changing pattern of electric current. • When a wave travels through a substance, particles move to and fro. • Energy is transferred in the direction of movement of the wave. • Waves of higher amplitude or higher frequency transfer more energy. • A physical model of a transverse wave demonstrates it moves from place to place, while the material it travels through does not. • The model describes the properties of speed, wavelength and reflection.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		

Resources	**Waves-** https://www.bbc.co.uk/bitesize/topics/zw982hv		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Amplitude, Frequency, Wavelength, Velocity, Medium, Reflection, Réfraction, Diffraction, Transverse, Longitudinal.			✓			
Numeracy	Calculating velocity of a wave Measuring angle of incidence and angle of refraction			✓			
Challenge	Describe how the velocity of ripples on the surface of water can be calculated.	✓					✓

Year 10

Topic	**Chemistry Paper 1**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of: Atomic structure and the periodic table, Bonding, structure and properties of matter, Quantitative chemistry, Chemical changes & Energy changes.						
Lesson Learning Intentions	**Atomic structure and the periodic table** • The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels. **Bonding, structure and the properties of matter**				✓	✓	✓

	• Chemists use theories of structure and bonding to explain the physical and chemical properties of materials. Analysis of structures shows that atoms can be arranged in a variety of ways, some of which are molecular while others are giant structures. Theories of bonding explain how atoms are held together in these structures. Scientists use this knowledge of structure and bonding to engineer new materials with desirable properties. The properties of these materials may offer new applications in a range of different technologies **<u>Quantitative chemistry</u>** • Chemists use quantitative analysis to determine the formulae of compounds and the equations for reactions. Given this information, analysts can then use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. Chemical reactions can be classified in various ways. Identifying different types of chemical reaction allows chemists to make sense of how different chemicals react together, to establish patterns and to make predictions about the behaviour of other chemicals. Chemical equations provide a means of representing chemical reactions and are a key way for chemists to communicate chemical ideas. **<u>Chemical changes</u>** • Understanding of chemical changes began when people began experimenting with chemical reactions in a systematic way and organizing their results logically. Knowing about these different chemical changes meant that scientists could begin to predict exactly what new substances would be formed and use this knowledge to develop a wide range of different materials and processes. It also helped biochemists to understand the complex reactions that take place in living organisms. The extraction of important resources from the earth makes use of the way that some elements and compounds react with each other and how easily they can be 'pulled apart'.						

	Energy changes • Energy changes are an important part of chemical reactions. The interaction of particles often involves transfers of energy due to the breaking and formation of bonds. Reactions in which energy is released to the surroundings are exothermic reactions, while those that take in thermal energy are endothermic. These interactions between particles can produce heating or cooling effects that are used in a range of everyday applications. Some interactions between ions in an electrolyte result in the production of electricity. Cells and batteries use these chemical reactions to provide electricity. Electricity can also be used to decompose ionic substances and is a useful means of producing elements that are too expensive to extract any other way.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	**Atomic structure and the periodic table playlist** AQA GCSE Chemistry Paper 1 Atomic Structure and the Periodic Table - YouTube **Structure, bonding and the properties of matter playlist** AQA GCSE Chemistry Paper 1 Structure and Bonding - YouTube **Quantitative Chemistry playlist** AQA GCSE Chemistry Paper 1 Quantitative Chemistry - YouTube **Chemical changes playlist** AQA GCSE Chemistry Paper 1 Chemical Reactions - YouTube **Energy changes playlist** AQA GCSE Chemistry Paper 1 Energy Changes - YouTube		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Atom, Element, Compound, Ion, Allotrope, Polymer, Redox, Exothermic, Endothermic, Electrolysis, Aqueous, Covalent, Acid, Base, Anion, Cation, Electrode.			✓			
Numeracy	Balancing equations Calculating relative formula mass			✓			

	Calculating moles Applying Avogadro's constant Calculating concentrations of solutions Converting cm^3 to dm^3 ($1000cm^3$ is equivalent to 1 dm^3) Calculating limiting reactants Apply the law of 'conservation of mass'						
Challenge	How do scientists calculate the mass of an atom when we can't see an atom?	✓					✓

Topic	**Physics Paper 1**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of: Energy, Electricity, Particle model of matter & Atomic structure.						
Lesson Learning Intentions	**<u>Energy</u>** • The concept of energy emerged in the 19th century. The idea was used to explain the work output of steam engines and then generalised to understand other heat engines. It also became a key tool for understanding chemical reactions and biological systems. Limits to the use of fossil fuels and global warming are critical problems for this century. Physicists and engineers are working hard to identify ways to reduce our energy usage. **<u>Electricity</u>**				✓	✓	✓

	• Electric charge is a fundamental property of matter everywhere. Understanding the difference in the microstructure of conductors, semiconductors and insulators makes it possible to design components and build electric circuits. Many circuits are powered with mains electricity, but portable electrical devices must use batteries of some kind. Electrical power fills the modern world with artificial light and sound, information and entertainment, remote sensing and control. The fundamentals of electromagnetism were worked out by scientists of the 19th century. However, power stations, like all machines, have a limited lifetime. If we all continue to demand more electricity this means building new power stations in every generation – but what mix of power stations can promise a sustainable future? **<u>Particle model of matter</u>** • The particle model is widely used to predict the behaviour of solids, liquids and gases and this has many applications in everyday life. It helps us to explain a wide range of observations and engineers use these principles when designing vessels to withstand high pressures and temperatures, such as submarines and spacecraft. It also explains why it is difficult to make a good cup of tea high up a mountain! **<u>Atomic structure</u>** • Ionising radiation is hazardous but can be very useful. Although radioactivity was discovered over a century ago, it took many nuclear physicists several decades to understand the structure of atoms, nuclear forces and stability. Early researchers suffered from their exposure to ionising radiation. Rules for radiological protection were first introduced in the 1930s and subsequently improved. Today radioactive materials are widely used in medicine, industry, agriculture and electrical power generation.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data				✓		

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- Discussion/Peer review
- Graph construction
- Calculation work

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<tr><td>Resources</td><td>Energy playlist AQA GCSE Physics Paper 1 Energy - YouTube
Electricity playlist AQA GCSE Physics Paper 1 Electricity - YouTube
Particle model of matter playlist AQA GCSE Physics Paper 1 Particle model of matter - YouTube
Atomic structure playlist AQA GCSE Physics Paper 1 Atomic Structure and Radioactivity - YouTube</td><td></td><td>✓</td><td></td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>DRAFT</td><td>This module includes a DRAFT task.</td><td></td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Literacy</td><td>Energy, joule, kinetic energy, elastic energy, system, thermal, conductivity, capacity, specific heat capacity, efficient, power, watt, conservation, gravitational potential energy, chemical energy, geothermal</td><td></td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Numeracy</td><td>

Word Equation	Symbol Equation
kinetic energy = 0.5 × mass × (speed)^2	$E_k = ½ m v^2$
(HT) gravitational potential energy = mass × gravitational field strength (g) × height	$E_p = m g h$
power = $\frac{\text{energy transferred}}{\text{time}}$	$p = \frac{E}{t}$
power = $\frac{\text{work done}}{\text{time}}$	$p = \frac{W}{t}$
efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$	
efficiency = $\frac{\text{useful power output}}{\text{total power input}}$	

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	charge flow = current × time	$Q = I\,t$						
	potential difference = current × resistance	$V = I\,R$						
	power = potential difference × current	$P = V\,I$						
	power = (current)^2 × resistance	$P = I^2\,R$						
	energy transferred = power × time	$E = P\,t$						
	energy transferred = charge flow × potential difference	$E = Q\,V$						
	$\text{density} = \frac{\text{mass}}{\text{volume}}$	$\rho = \frac{m}{V}$						
Challenge	Research how female scientists, such as Marie Curie, have contributed to our current understanding of radiation and radioactivity.		✓					✓

Topic	**Biology Paper 1**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of: Cell biology, Organisation, Infection & response and Bioenergetics.						
Lesson Learning Intentions	**<u>Cell Biology</u>** • Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon				✓	✓	✓

	has led to the development of stem cell technology. This is a new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells. **Organisation** • In this section we will learn about the human digestive system which provides the body with nutrients and the respiratory system that provides it with oxygen and removes carbon dioxide. In each case they provide dissolved materials that need to be moved quickly around the body in the blood by the circulatory system. Damage to any of these systems can be debilitating if not fatal. Although there has been huge progress in surgical techniques, especially with regard to coronary heart disease, many interventions would not be necessary if individuals reduced their risks through improved diet and lifestyle. We will also learn how the plant's transport system is dependent on environmental conditions to ensure that leaf cells are provided with the water and carbon dioxide that they need for photosynthesis. **Infection and response** • Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria. Unfortunately, many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics.						

	Bioenergetics • In this section we will explore how plants harness the Sun's energy in photosynthesis in order to make glucose. This process liberates oxygen which has built up over millions of years in the Earth's atmosphere. Both animals and plants use this oxygen to oxidise food in a process called aerobic respiration which transfers the energy that the organism needs to perform its functions. Conversely, anaerobic respiration does not require oxygen to transfer energy. During vigorous exercise the human body is unable to supply the cells with sufficient oxygen and it switches to anaerobic respiration. This process will supply energy but also causes the build-up of lactic acid in muscles which causes fatigue.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	**Cell biology playlist** AQA GCSE Biology Paper 1 Cell Biology - YouTube **Organisation playlist** AQA GCSE Biology Paper 1 Organisation - YouTube **Infection and response playlist** AQA GCSE Biology Paper 1 Infectious Diseases - YouTube **Bioenergetics playlist** AQA GCSE Biology Paper 1 Bioenergetics - YouTube		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Microscopy, Chromosome, Mitosis, Diffusion, Osmosis, Active transport, Enzyme, Communicable diseases, Non-communicable disease, Transpiration, Translocation, Pathogen, Photosynthesis, Respiration, Metabolism, Aerobic, Anaerobic			✓			
Numeracy	Calculating: magnification, image size & real size Calculating percentage increase and decrease (e.g. calculating the % increase in mass of a potato cylinder) Calculating surface area to volume ratio			✓			

	Calculating rate of photosynthesis Using the inverse square law to calculate light intensity Balancing equations (e.g. photosynthesis/respiration)						
Challenge	Are viruses living or non-living? Evaluate this statement.	✓					✓

Year 11

Topic	**Chemistry Paper 2**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of: The rate and extent of chemical change, Organic chemistry, Chemical analysis, Chemistry of the atmosphere and Using resources.						
Lesson Learning Intentions	**<u>The rate and extent of chemical change</u>** • Chemical reactions can occur at vastly different rates. Whilst the reactivity of chemicals is a significant factor in how fast chemical reactions proceed, there are many variables that can be manipulated in order to speed them up or slow them down. Chemical reactions may also be reversible and therefore the effect of different variables needs to be established in order to identify how to maximise the yield of desired product. Understanding energy changes that accompany chemical reactions is important for this process. In industry, chemists and chemical engineers determine the effect of different variables on reaction rate and yield of product. Whilst there may be compromises to be made, they carry out optimisation processes to ensure that enough product is produced within a sufficient time, and in an energy-efficient way. **<u>Organic chemistry</u>** • The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds				✓	✓	✓

	are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents. **Chemical analysis** • Analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Instrumental methods provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small. Forensic scientists and drug control scientists rely on such instrumental methods in their work. **Chemistry of the atmosphere** • The Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists use very complex software to predict weather and climate change as there are many variables that can influence this. The problems caused by increased levels of air pollutants require scientists and engineers to develop solutions that help to reduce the impact of human activity. **Using resources** • Industries use the Earth's natural resources to manufacture useful products. In order to operate sustainably, chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. Chemists also aim to develop ways of disposing of products at the						

	end of their useful life in ways that ensure that materials and stored energy are utilised. Pollution, disposal of waste products and changing land use has a significant effect on the environment, and environmental chemists study how human activity has affected the Earth's natural cycles, and how damaging effects can be minimised.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	**The rate and extent of chemical change playlist** AQA GCSE Chemistry Paper 2 Rates of Reaction - YouTube **Organic chemistry playlist** AQA GCSE Chemistry Paper 2 Organic Chemistry - YouTube **Chemical analysis playlist** AQA GCSE Chemistry Paper 2 Chemical Analysis - YouTube **Chemistry of the atmosphere playlist** AQA GCSE Chemistry Paper 2 The Atmosphere - YouTube **Using resources playlist** AQA GCSE Chemistry Paper 2 Resources - YouTube		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Hydrocarbon, Fractional distillation, Cracking, Polymer, Formulation, Purity, Chromatography, Finite, Potable, Effluent, Sterilisation.			✓			
Numeracy	Rate of reaction = amount of product used *or* amount of product formed ÷ time. Calculating rate of reaction from a graph. Using tangents to calculate rate of reaction. Rf = distance travelled by substance ÷ distance travelled by solvent.			✓			
Challenge	How can chromatography be used by forensic scientists to help convict a criminal?	✓					✓

Topic	Physics Paper 2	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of: Forces, Waves, Magnetism & electromagnetism.						
Lesson Learning Intentions	**<u>Forces</u>** • Engineers analyse forces when designing a great variety of machines and instruments, from road bridges and fairground rides to atomic force microscopes. Anything mechanical can be analysed in this way. Recent developments in artificial limbs use the analysis of forces to make movement possible. **<u>Waves</u>** • Wave behaviour is common in both natural and man-made systems. Waves carry energy from one place to another and can also carry information. Designing comfortable and safe structures such as bridges, houses and music performance halls requires an understanding of mechanical waves. Modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves. **<u>Magnetism and electromagnetism</u>** • Electromagnetic effects are used in a wide variety of devices. Engineers make use of the fact that a magnet moving in a coil can produce electric current and also that when current flows around a magnet it can produce movement. It means that systems that involve control or communications can take full advantage of this.				✓	✓	✓
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review				✓		

	• Graph construction • Calculation work						
Resources	**Forces playlist** AQA GCSE Physics Paper 2 Forces - YouTube **Waves playlist** AQA GCSE Physics Paper 2 Waves - YouTube **Magnetism and electromagnetism playlist** AQA GCSE Physics Paper 2 Magnetism - YouTube		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Force, Mass, Weight, Gravity, Resultant force, Scalar, Vector, Elasticity, Inertia, Momentum, Acceleration, Terminal Velocity, Réfraction, Rarefaction, Diffraction, Electromagnet.			✓			
Numeracy							
Challenge	How can we use a microwave oven to calculate the speed of light?	✓					✓

Word Equation	Symbol Equation
weight = mass × gravitational field strength (g)	$W = m\ g$
work done = force × distance (along the line of action of the force)	$W = F\ s$
force applied to a spring = spring constant × extension	$F = k\ e$
distance travelled = speed × time	$s = v\ t$
$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$	$a = \frac{\Delta v}{t}$
resultant force = mass × acceleration	$F = m\ a$
momentum = mass × velocity	$p = m\ v$
wave speed = frequency × wavelength	$v = f\ \lambda$

Topic	**Biology Paper 2**	C	R	E	A	T	E
NC Learning Intention	Understand and apply the principles of: Homeostasis and response, Inheritance, variation & evolution & Ecology.						
Lesson Learning Intentions	**Homeostasis and response**				✓	✓	✓

	• Cells in the body can only survive within narrow physical and chemical limits. They require a constant temperature and pH as well as a constant supply of dissolved food and water. In order to do this the body requires control systems that constantly monitor and adjust the composition of the blood and tissues. These control systems include receptors which sense changes and effectors that bring about changes. In this section we will explore the structure and function of the nervous system and how it can bring about fast responses. We will also explore the hormonal system which usually brings about much slower changes. Hormonal coordination is particularly important in reproduction since it controls the menstrual cycle. An understanding of the role of hormones in reproduction has allowed scientists to develop not only contraceptive drugs but also drugs which can increase fertility. **Inheritance, variation and evolution** • In this section we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species evolve. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them into the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial. **Ecology**						

	• The Sun is a source of energy that passes through ecosystems. Materials including carbon and water are continually recycled by the living world, being released through respiration of animals, plants and decomposing microorganisms and taken up by plants in photosynthesis. All species live in ecosystems composed of complex communities of animals and plants dependent on each other and that are adapted to particular conditions, both abiotic and biotic. These ecosystems provide essential services that support human life and continued development. In order to continue to benefit from these services humans need to engage with the environment in a sustainable way. In this section we will explore how humans are threatening biodiversity as well as the natural systems that support it. We will also consider some actions we need to take to ensure our future health, prosperity and well-being.						
Lesson Tasks	• Low stakes knowledge retrieval exercise (LSKRE) to advise or inform adaptive teaching • Exam-style questions (short response and extended response) • Practical work • Analysis of qualitative/quantitative data • Discussion/Peer review • Graph construction • Calculation work				✓		
Resources	**Homeostasis and response playlist** AQA GCSE Biology Paper 2 Homeostasis - YouTube **Inheritance, variation and evolution playlist** GCSE Biology Revision "Variation" - YouTube **Ecology playlist** AQA GCSE Biology Paper 2 Ecology - YouTube		✓		✓		✓
DRAFT	This module includes a DRAFT task.		✓				
Literacy	Homeostasis, nervous system, endocrine system, hormone, pituitary gland, pancreas, neurone, spinal cord, oestrogen, testosterone, ovulation, contraception, stimulus, receptor, effector, chromosomes, genes, meiosis, variation, genetic engineering, selective breeding, homozygous, heterozygous, dominant, recessive, polydactyl, cystic fibrosis, evolution, natural selection, sexual			✓			
Numeracy	Calculating the speed of an electrical impulse travelling along a neurone. Calculating reaction time using a ruler and conversion table. Calculating the mean number of a plant species. Calculating population size of an organism in one area.			✓			
Challenge	How can thermoregulation in mammals be linked to the temperature regulation of a fridge freezer?	✓					✓