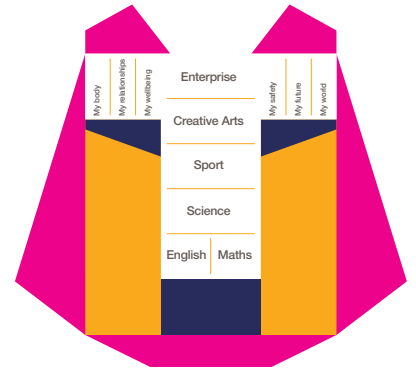


Science



The Science curriculum consists of three steps.

Build

In the Build stage students will study the ‘Exploring Science: Working Scientifically’ programme which seeks to give learners a love for learning and equip them with some of the skills and knowledge needed to help prepare them for a GCSE.

Grow

In the Grow stage students will continue with the ‘Exploring Science approach, and build on the big ideas of Science help students make the cognitive links necessary from a year 7 to a year 11 curriculum. The emphasis is very much to prepare students thoroughly for their GCSE single award combined Science.

Launch

In the launch stage we teach students the course content for their International GCSE Single Award in Combined Science.

Build

In the 'Build' and 'Grow' stage, students will develop their ideas, skills, knowledge and understanding of the three big ideas in Biology, Chemistry and Physics. These are:

Biology: cells and cellular processes, Biological systems for life and organisms and their interactions with the environment

Chemistry: Materials and their properties, chemical changes and our earth and its atmosphere

Physics: energy, forces and fields and matter and materials

In the Biology 'Build' stage, students will learn about:

Cells and cellular processes

- › Students will understand and learn about respiration,
- › Students will learn about unicellular organisms and diffusion
- › Students will gain a full understanding of photosynthesis, the process and be able to describe and fully illustrate it.

Biology – Biological systems for life:

- › Students will understand and learn about food groups and deficiency diseases
- › Students will learn about Ventilation, Drugs and toxins
- › Students will gain a full understanding of organisms and their interactions with the environment and plant reproduction.
- › They will also learn about human impact.

In Chemistry students will learn about:

Chemistry – Chemical changes

- › Students will gain a full understanding of physical and chemical change, the process and be able to describe and fully illustrate it.

- › Students will understand and learn about atoms and elements
- › Students will learn about reactions of acids and combustion
- › Chemistry - Our Earth and its atmosphere:
- › Students will understand and learn about metals and alloys.
- › Students will learn about reactions of metals

In Physics students will learn about:

Physics – Matter and materials

- › Students will gain a full understanding of Solids, liquids, and gases

Physics – Energy

- › Students will understand and learn about how light travels,
- › Students will gain a full understanding of light reflection and refraction
- › Students will learn about sound (production and transmission of sound)
- › Students will gain a full understanding of applications of sound and the ear

Physics – Forces and fields:

- › Students will learn about static electricity
- › Students will learn about The Earth and Space
- › Students will understand and learn about magnets and electromagnets

Grow

In the Biology 'Grow' stage, students will learn about:

Biology – Organisms and their interactions with the environment

- › Students will understand and learn about variation and adaptations
- › Students will gain a full understanding of evolution and extinction
- › Students will learn about biological systems for life
- › Students will gain a full understanding of digestion and enzymes
- › Students will understand and learn about dietary components

Biology – Cells and cellular processes

- › Students will understand and learn about the nucleus
- › Students will gain a full understanding of prokaryotic and eukaryotic cells
- › Students will learn about microscopy and magnification
- › Students will gain a full understanding of the movement of substances

In the Chemistry 'Grow' stage students will learn about:

Chemistry – Materials and their properties

- › Students will learn about atomic structure
- › Students will understand and learn about water
- › Students will understand and learn about separations, and bonding
- › Students will gain an understanding of the periodic table

Chemistry – Chemical changes

- › Students will gain a full understanding of the pH scale

- › Students will understand and learn about further reactions of acids
- › Chemistry - Our Earth and its atmosphere:
- › Students will understand and learn about how to solve problems with chemistry

In the Physics 'Grow' stage students will learn about:

Physics – Matter and materials

- › Students will gain an understanding of, and be able to describe atoms

Physics – Energy

- › Students will learn about Heat Energy Transfer
- › Students will learn about Energy and efficiency (Energy Stores and Transfers)
- › Students will learn about Energy and efficiency (Efficiency and energy resources)
- › Students will understand and learn about Waves and the Electromagnetic Spectrum
- › Students will be able to describe forces and fields
- › Students will be able to describe motion, and acceleration
- › Students will gain an understanding of forces, fields, and pressure

Launch

In the 'Launch' stage, students will cover topics in each of the areas, broadly broken into the following subject areas:

Biology

- › The nature and variety of living organisms
- › Structures and functions in living organisms
- › Reproduction and inheritance
- › Ecology and the environment
- › Use of biological resources

Chemistry

- › Principles of chemistry
- › Inorganic chemistry
- › Physical chemistry
- › Organic chemistry

Physics

- › Forces and motion
- › Electricity
- › Waves
- › Energy resources and energy transfers
- › Solids, liquids and gases
- › Magnetism and electromagnetism
- › Radioactivity and particles
- › Astrophysics

Students will develop skills in Critical Thinking. For instance in:

Biology – Critical Thinking

- › Understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient.
- › Students will understand the need for a transport system in multicellular organisms
- › Students will understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting

pathogens and lymphocytes releasing antibodies specific to the pathogen.

Chemistry – Critical Thinking

- › Students will understand how elements are arranged in the Periodic Table: • in order of atomic number • in groups and periods.
- › Students will understand why compounds with giant ionic lattices have high melting and boiling points.
- › Students will understand how to deduce the structure of a monomer from the repeat unit of an addition polymer and vice versa.

Physics – Critical Thinking

- › Describe the factors affecting vehicle stopping distance, including speed, mass, road condition and reaction time.
- › Students will describe a variety of everyday and scientific devices and situations, explaining the transfer of the input energy in terms of the above relationship, including their representation by Sankey diagrams.
- › Students will understand why a force is exerted on a current-carrying wire in a magnetic field, and how this effect is applied in simple d.c. electric motors and loudspeakers.

Students will develop skills in Problem Solving. For instance, in:

Biology – Problem Solving

- › Understand the processes of diffusion, osmosis, and active transport by which substances move into and out of cells.
- › Understand how adaptations of red blood cells make them suitable for the transport of oxygen, including shape, the absence of a nucleus and the presence of haemoglobin.
- › Understand how the structure of the male and female reproductive systems are adapted for their functions.

Launch

Chemistry – Problem Solving

- › Understand how to classify a substance as an element, a compound or a mixture.
- › Students will explain why substances with simple molecular structures gases or liquids are, or solids with low melting and boiling points.
- › Students will know that carbon dioxide is a greenhouse gas and that increasing amounts in the atmosphere may contribute to climate change.

Physics – Problem Solving

- › Describe the effects of forces between bodies such as changes in speed, shape or direction.
- › Students will understand how the current in a series circuit depends on the applied voltage and the number and nature of other components. Use the left-hand rule to predict the direction of the resulting force when a wire carries a current perpendicular to a magnetic field.
- › Understand the role of shielding around a nuclear reactor

Students will develop skills in Analysis.
For instance:

Biology – Analysis

- › Understand how temperature changes can affect enzyme function, including changes to the shape of active site
- › Understand how factors affect the rate of movement of substances into and out of cells, including the effects of surface area to volume ratio, distance, temperature and concentration gradient
- › Investigate the population size of an organism in two different areas using quadrats

Chemistry – Analysis

- › Students will be able to calculate the relative atomic mass of an element (Ar) from isotopic abundances

- › Students will calculate relative formula masses (including relative molecular masses) (Mr) from relative atomic masses (Ar)
- › Students will understand how to determine the percentage by volume of oxygen in air using experiments involving the reactions of metals (e.g. iron) and non-metals (e.g. phosphorus) with air
- › Students will calculate the heat energy change from a measured temperature change using the expression $Q = mc\Delta T$

Physics – Analysis

- › Students will plot and explain distance–time graphs
- › Students will calculate the currents, voltages and resistances of two resistive components connected in a series circuits

Students will develop skills in Reasoning.
For instance in:

Biology – Reasoning

- › Understand the term pathogen and know that pathogens may include fungi, bacteria, Protoctista or viruses.
- › Students will understand how temperature changes can affect enzyme function, including changes to the shape of active site
- › Students will understand how the immune system responds to disease using white blood cells, illustrated by phagocytes ingesting pathogens and lymphocytes releasing antibodies specific to the pathogen Chemistry
- › Students will understand how the similarities in the reactions of these elements with water provide evidence for their recognition as a family of elements
- › Students will use knowledge of trends in Group 7 to predict the properties of other halogens

Launch

Physics – Reasoning

- › Understand how stars can be classified according to their colour

Students will develop skills in Interpretation. For instance in:

Biology – Interpretation

- › Understand the role of the intercostal muscles and the diaphragm in ventilation
- › Students will understand how genes exist in alternative forms called alleles which give rise to differences in inherited characteristics
- › Students will explain Darwin’s theory of evolution by natural selection
- › Students will understand feeding relationships

Chemistry – Interpretation

- › Know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (A_r)
- › Students will understand how metals can be arranged in a reactivity series based on their reactions with: • water • dilute hydrochloric or sulfuric acid
- › Students will understand how to draw the structural and displayed formulae for alkanes with up to five carbon atoms in the molecule, and to name the unbranched-chain isomers

Physics – Interpretation

- › Plot and explain velocity-time graphs
- › Students will describe energy transfers involving energy stores: chemical, kinetic, gravitational, elastic, thermal, magnetic, electrostatic, nuclear. Energy transfers: mechanically, electrically, by heating, by radiation (light and sound)
- › Students will describe the nature of alpha particles, beta particles, and gamma rays, and recall that they may be distinguished in terms of penetrating power and ability to ionise

Students will develop skills in Decision Making. For instance in:

Biology – Decision Making

- › Students will investigate food samples for the presence of glucose, starch, protein and fat
- › Students will investigate how enzyme activity can be affected by changes in temperature
- › Practically investigate the role of anaerobic respiration by yeast in different conditions

Chemistry – Decision Making

- › Students will describe these experimental techniques for the separation of mixtures: simple distillation, fractional distillation, filtration, crystallisation, paper chromatography

Students will develop skills in Adaptive Learning. For instance in:

Biology – Adaptive Learning

- › Students will describe the common features shown by eukaryotic organisms: plants, animals, fungi and Protoctista
- › Students will know the similarities and differences in the structure of plant and animal cells. Students will understand the terms population, community, habitat and ecosystem
- › Students can understand how abiotic and biotic factors affect the population size and distribution of organisms

Chemistry – Adaptive Learning

- › Students will understand the three states of matter in terms of the arrangement, movement and energy of the particles
- › Students will know what is meant by the terms atomic number, mass number, isotopes and relative atomic mass (A_r)
- › Students will know that chemical reactions in which heat energy is given out are described as exothermic, and those in which heat energy is taken in are described as endothermic

Launch

Physics – Adaptive Learning

- › Students will know the difference between mains electricity being alternating current (a.c.) and direct current (d.c.) being supplied by a cell or battery
- › Students will know that light is part of a continuous electromagnetic spectrum that includes radio, microwave, infrared, visible, ultraviolet, x-ray and gamma ray radiations and that all these waves travel at the same speed in free space
- › Students will Explain that gravitational force: causes moons to orbit planets, causes the planets to orbit the Sun, causes artificial satellites to orbit the Earth, causes comets to orbit the Sun. And the transferable skills to enable them to respond with confidence to the demands of undergraduate study and the world of work.

Through Science iGCSE we are aiming to:

- › Increase awareness of transferable skills that are already being assessed (for both students and teachers)
- › Indicate where, for teachers, there are opportunities to teach additional skills that won't be formally assessed, but that would be of benefit to students. These transferable skills, or competencies, will provide students with 'the bundle of knowledge, attributes and capacities that can be learned and that enable individuals to perform an activity or task successfully and consistently.