2023/24

Science Subject Overview
The Appleton School

Contents

Subject: Science

Overall Curriculum Intent – Our Vision and Aims (linked to the National Curriculum and Specifications)

To ensure all students leave The Appleton School with a greater appreciation of how the world works. By arming our students with the skills and knowledge to question the world around them, using evidence and data to inform their opinions, we can ensure they leave us equipped to be the leaders of tomorrow.

We follow the National Curriculum at KS3 and AQA Combined Science Trilogy at KS4, with our most passionate students opting for Triple Science. We ensure that our KS3 curriculum prepares our students for their GCSE years but also with the core skills/knowledge would need as a future scientist.

Science is an exciting subject which is constantly evolving and changing, as world-changing news breaks in the world of science we cover it in our science lessons e.g. discovery of Higgs Boson, stem cell research, etc. Our curriculum follows the work of many British scientists to facilitate their learning of living things. These include the work of Charles Darwin and the theory of evolution, to John Snow and his extensive influence on understanding disease and Edward Jenner's work on vaccination, Dalton and Rutherford's work on the atom, and the global impact of these scientists' work.

Scheme of work highlights career links based on the Gatsby benchmarks and links to scientists from diverse backgrounds.

Students would not have, traditionally, been exposed to scientific texts/research at KS2; this is a skill they develop up to KS5. The application of root words (prefixes and suffixes) are vital to help the understanding of specialist terminology in Science, which needs developing and building upon from KS2, but an expectation that they are aware of this concept. Students need to have a working knowledge of comparison of texts and understanding what they read to help with research skills they develop in physics. An underpinning of any scientific discipline is the ability to distinguish fact and opinion. For numeracy we expect students to have a sound knowledge of ratios, square numbers, proportion, basic algebra, factors and multipliers, adding, subtracting, multiplying, division, fractions, percentages and decimals. These core numeracy skills allow a focus on

the Science content and then mathematics being used as a tool to support the learning. It is obvious that not all students come to The Appleton School with these skills acquired, identifying these gaps early are crucial to the success of teaching Science.

How is the curriculum delivered?

Science is a broad subject covering many topics, a vast amount of knowledge and skills that develop over the Key Stages. The curriculum delivery tries to foster the idea of a mastery curriculum, which is challenging due to the wide number of topics covered in the Science Curriculum.

In the context of the Science curriculum for Key Stages 3 to 5 (ages 11-18), the curriculum is organised into separate key stages:

1. **Key Stage 3 (KS3):** This stage covers students aged 11 to 14 and focuses on building a solid foundation in science. Topics include biology, chemistry, and physics, and the curriculum aims to develop students' scientific knowledge, understanding, and skills.
2. **Key Stage 4 (KS4) - GCSE:** This stage, usually taken between the ages of 14 and 16, leads to the General Certificate of Secondary Education (GCSE) examinations. Students may choose to study separate sciences (biology, chemistry, and physics) or a combined science course.
3. **Key Stage 5 (KS5)** - A-levels or equivalent: Students aged 16 to 18 typically study Advanced Level (A-level) courses or vocational qualifications. This stage allows for more in-depth exploration of specific scientific disciplines.

While the science curriculum may not be explicitly designed as a mastery system, some teaching practices and approaches align with the principles of mastery learning. Key elements of a mastery system that may be incorporated include:

1. **Clear Learning Objectives:** Each lesson or unit has clear, specific learning objectives that students are expected to master.
2. **Formative Assessment:** Ongoing assessment and feedback are used to identify areas of weakness and provide additional support until students demonstrate mastery.
3. **Repeat Starters:** Students have “repeat” questions at the start of each lesson that recall knowledge and understanding from previous lessons and previous topics.
4. **Adaptability**: Teachers provide varied learning experiences and support to student of varying abilities.
5. **Depth of Understanding:** Emphasis is placed on a deep understanding of concepts rather than simply covering a broad range of topics.
6. **Peer Collaboration:** Opportunities for students to collaborate with peers in problem-solving and discussions to reinforce their understanding.

How is the curriculum assessed?

Rationale: Science is complex in structure, with three subjects under one area; students can find it challenging to retain the high levels of content retrieval and skill development. Therefore, it is vital that assessment plays a rigorous and regular part of the science curriculum to ensure all students are regularly retrieving information, learning revision and exam techniques, and classroom teachers identifying misconceptions and areas of improvement that the students can work on earlier and rectify to support their educational learning journey.

Assessment Model: Since moving back to a three-year curriculum we have been focussing on our assessment process to ensure that there is the development of skills and retention of knowledge is constantly revisited, below is an overview of what we are working towards in Science.

KS3 – Half termly assessments focused on short-term retrieval but also on a breadth of information for this the best assessment model will be a focus on multiple choice questions. At the end of every term, we focus on long term retrieval of all material learn to that point, including previous years, the style of the exams will also allow for a focus on short answer questions and extended writing – developing those exam skills the students will need at the end of Year 11 and Year 13. Every assessment will have improvement tasks for students and dedicated time to allow students to work on areas of weakness, this will allow students to tackle misconceptions before they become imbedded knowledge. Our examinations are common across all students allowing for comparative data, examinations are standardised and constructed on a model of increased difficulty covering all assessment objectives and all aspects of the National Curriculum across the three years.

KS4 – We have two routes in Science: Combined Science and Separate Science. In Separate Science students will have separate Biology, Chemistry and Physics assessments every half term, these assessments will have a cumulative element to ensure long-term retention and regular revisiting of previous learning. In Combined Science students also have half termly assessments that cover all three sciences and will also contain previous knowledge to ensure long-term retrieval practice. Assessments are common across all classes but as students approach Year 11 they may have foundation tier papers which cover the same material but have a different scale of questioning. Across the two years students will have three mock exams, using past papers and established grade boundaries. All examinations will have improvement tasks and dedicated time to work on areas of weakness. Half termly exams are standardised and mock examinations are moderated for consistency across the department and to ensure there is comparable data to target our intervention for students.

KS5 - End of topic tests completed by all staff for comparable data, these examinations will model the style of the final assessment in Year two. Across the two years of study the students will have three mock exams that cover all learnt material for long-term retrieval, these are the secure past papers and using the established grade boundaries. Similar to the lower key stages the students will have improvement tasks and dedicated time to work on areas of weakness. Exams are constructed using the exam board software that allows for scaling of questioning and similar style of questioning to the final assessment.

How is the curriculum enriched through speakers, visits or clubs to generate a love of learning?

The Science Department are continuing to develop opportunities for students to learn, explore and engage with Science outside of the classroom. Students who do engage with the subject outside of lesson time are celebrated with letters and postcards home, awarding of merits and openly praising students. Students can also work towards achieving their Science Ambassador badges.

Extra-Curricular

We offer a Science Club after school where students can work toward their Crest Awards, an Eco-Warriors group that looks at trying to make the school site more environmentally friendly (they have introduced plastic recycling in the canteen and planted saplings around the fence line), and a Science on Netflix club where students can explore Science shows on Netflix. At KS4 and KS5 we offer intervention and revision for our exam classes supporting our students in being prepared for their assessments. At KS5, Chemistry offer the opportunity to enter the Chemistry Olympiad and Physics offer support for students applying to Oxford by supporting their revision for the Physics Aptitude Test PAT).

Visits

As a department we are looking to expand opportunities for Educational Visits for KS3 and KS4. At KS5, Biology visit Colchester Zoo to look at adaptation, evolution, and animal behaviour. For Physics, students visit Sizewell B in Year 12, which links together their studies on nuclear fission and electricity, further to this the apprenticeship opportunities are excellent and give the students a great insight into the world of work; in Year 13 students go to Jodrell Bank to support their Astrophysics studies but we will shortly be starting our CERN trip to replace this visit.

Speakers

We are always looking for opportunities to show students the world of science beyond the classroom. An inflatable observatory, run by a Fellow of the Royal Astronomical Society, offers astronomy shows for the Year 7 students teaching them about the night sky. The historic Royal Institution run two live shows for our Year 7 & 8 students, followed up by a community show (for our primary feeders) and then a CPD session for staff. Y11 Separate Scientists (and Y13 physicists) have a speaker from the University of Cambridge's Institute of Astronomy to support their study of P15 – Space. The KS5 Physics students also have a speaker into school, who was the former Head of High Resolution Radar and Non Co-

operative Target Recognition at BAE Systems Integrated System Technologies; this gave students an interesting insight into the world of experimental physics. KS5 Chemists have virtual access to King's College London, Department of Chemistry's annual Daniell Lecture.

What skills and knowledge do students bring with them from Key Stage Two to Year 7?

Our aim to produce a broad and balanced curriculum is based on recognising the importance of the transition between Key Stage 2 and Key Stage 3. We have worked hard to ensure that our schemes of work reflect the knowledge and skills students will enter our curriculum with. We strengthen our knowledge of students' abilities with the use of assessments at the start of Year 7 to further understand what students should be able to do. This information is supported further by visiting local primary schools to share information, examples of work and share resources.

In KS2 Pupils should have covered:

Living things and their habitats

describe the differences in the life cycles of a mammal, an amphibian, an insect and a bird
describe the life process of reproduction in some plants and animals
describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals
give reasons for classifying plants and animals based on specific characteristics

Animals, including humans

describe the changes as humans develop to old age
identify and name the main parts of the human circulatory system, and describe the functions of the heart, blood vessels and blood
recognise the impact of diet, exercise, drugs and lifestyle on the way their bodies function
describe the ways in which nutrients and water are transported within animals, including humans
Evolution and inheritance

Pupils should be taught to:

recognise that living things have changed over time and that fossils provide information about living things that inhabited the Earth millions of years ago
recognise that living things produce offspring of the same kind, but normally offspring vary and are not identical to their parents
identify how animals and plants are adapted to suit their environment in different ways and that adaptation may lead to evolution

States of matter

Compare and group materials together, according to whether they are solids, liquids or gases
Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C)
Identify the part played by evaporation and condensation in the water cycle and associate the rate of evaporation with temperature.
Rocks
Compare and group together different kinds of rocks on the basis of their appearance and simple physical properties
Describe in simple terms how fossils are formed when things that have lived are trapped within rock
Recognise that soils are made from rocks and organic matter
Properties and changes of materials
Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity (electrical and thermal), and response to magnets
Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
Use knowledge of solids, liquids and gases to decide how mixtures might be separated, including through filtering, sieving and evaporating
Give reasons, based on evidence from comparative and fair tests, for the particular uses of everyday materials, including metals, wood and plastic
Demonstrate that dissolving, mixing and changes of state are reversible changes
Explain that some changes result in the formation of new materials, and that this kind of change is not usually reversible, including changes associated with burning and the action of acid on bicarbonate of soda.

Earth and space

Describe the movement of the Earth, and other planets, relative to the Sun in the solar system

Describe the movement of the Moon relative to the Earth
Describe the Sun, Earth and Moon as approximately spherical bodies
Use the idea of the Earth's rotation to explain day and night and the apparent movement of the sun across the sky.

Forces

explain that unsupported objects fall towards the Earth because of the force of gravity acting between the Earth and the falling object
identify the effects of air resistance, water resistance and friction, that act between moving surfaces
recognise that some mechanisms including levers, pulleys and gears allow a smaller force to have a greater effect

Light

recognise that light appears to travel in straight lines
use the idea that light travels in straight lines to explain that objects are seen because they give out or reflect light into the eye
explain that we see things because light travels from light sources to our eyes or from light sources to objects and then to our eyes
use the idea that light travels in straight lines to explain why shadows have the same shape as the objects that cast them

Electricity

associate the brightness of a lamp or the volume of a buzzer with the number and voltage of cells used in the circuit compare and give reasons for variations in how components function, including the brightness of bulbs, the loudness of buzzers and the on/off position of switches use recognised symbols when representing a simple circuit in a diagram

Working scientifically

During years 5 and 6, pupils should be taught to use the following practical scientific methods, processes and skills through the teaching of the programme of study content:
Planning different types of scientific enquiries to answer questions, including recognising and controlling variables where necessary
Taking measurements, using a range of scientific equipment, with increasing accuracy and precision, taking repeat readings when appropriate

Recording data and results of increasing complexity using scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
Using test results to make predictions to set up further comparative and fair tests
Reporting and presenting findings from enquiries, including conclusions, causal relationships and explanations of and degree of trust in results, in oral and written forms such as displays and other presentations
Identifying scientific evidence that has been used to support or refute ideas or arguments.

https://assets.publishing.service.gov.uk/media/5a806ebd40f0b62305b8b1fa/PRIMARY_national_curriculum_-_Science.pdf

What skills and knowledge do students develop across Key Stage Three

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced):

The Key Stage 3 (KS3) Science curriculum, aligned with the National Curriculum, meticulously guides students through a progressive exploration of biology, chemistry, and physics, fostering the development of vital scientific skills.

In Year 7, following the National Curriculum guidelines, students embark on their scientific journey by understanding the principles of the scientific method. They formulate hypotheses and engage in foundational experiments that emphasise observation, measurement, and data recording. This aligns with the curriculum's focus on developing fundamental practical skills.

Year 8 builds upon this foundation, adhering to the National Curriculum's framework. Students delve into more intricate biological concepts such as cell structure, and chemistry experiments extend to cover chemical reactions. Physics investigations explore forces, motion, and energy transfer. The National Curriculum's emphasis on scientific knowledge and skills development is evident as students refine their experimental techniques, focusing on experimental design, precision, and data analysis.

In Year 9, the curriculum progresses further, aligning with the National Curriculum's objectives. Advanced scientific principles, including genetics, chemical equations, and energy transformations, become central themes. Students, in accordance with the National Curriculum's goals, enhance their experimental skills to a higher level of sophistication. They gain the ability to independently design and execute experiments, emphasising technique refinement, drawing conclusions, and critically evaluating outcomes.

Practical work remains integral throughout KS3, in line with the National Curriculum's emphasis on combining theoretical understanding with hands-on experience. Regular assessments, aligned with National Curriculum standards, not only assess knowledge but also evaluate the application of experimental skills. By the end of KS3, students are equipped with a well-rounded scientific skill set, aligning with the National Curriculum's objective of preparing them for more specialised study at higher educational levels.
Across the Key Stage 3 (KS3) Science curriculum, students will develop a broad and foundational understanding of scientific principles across biology, chemistry, and physics. Here's a breakdown:

1. Scientific Methodology: Students will learn to apply the scientific method, formulating hypotheses, designing experiments, and analysing results. This will foster critical thinking and problem-solving skills.
2. Biology: In Year 7, students will explore basic biological concepts like cells, classification, and reproduction. In Year 8, the focus will shift to more complex topics such as genetics, ecosystems, and human biology. By Year 9, they will delve into advanced areas like evolution, homeostasis, and contemporary scientific advancements like biotechnology.
3. Chemistry: The chemistry curriculum will progress from fundamental concepts in Year 7 (e.g., atoms, elements) to more intricate topics in Year 8 (e.g., chemical reactions, the periodic table). Year 9 will involve exploring chemical equations, organic chemistry, and staying abreast of modern advancements, including nanotechnology.
4. Physics: Physics concepts will evolve from simple forces and motion in Year 7 to more complex topics like energy, electricity, and magnetism in Year 8. Year 9 will cover advanced physics principles such as waves, light, and the electromagnetic spectrum, and introduce students to the latest scientific advancements in these areas.
5. Practical Skills: Throughout KS3, there will be a continuous emphasis on developing practical skills. Students will start with basic experimental techniques in Year 7, progress to more sophisticated investigations in Year 8, and refine their independent experimental abilities by Year 9, including hands-on experiences related to nanotechnology and biotechnology.
6. Interdisciplinary Understanding: The curriculum will encourage an interdisciplinary approach, showcasing how biology, chemistry, and physics intersect, incorporating the latest scientific advancements in areas like nanotechnology and biotechnology.
7. Scientific Literacy: Students will develop the ability to understand, evaluate, and communicate scientific information, including interpreting data from the latest scientific advancements. This will involve using scientific vocabulary and critically analysing findings to stay informed about cutting-edge developments.

By the end of KS3, students should have a solid foundation in scientific knowledge and skills, incorporating the latest advancements in fields like nanotechnology and biotechnology, setting the stage for more specialised study at the GCSE level and beyond.

What skills and knowledge do students develop in GCSE?

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

The transition from KS3 Science to GCSE AQA Combined Science Trilogy is enriched by the inclusion of AQA Science Required Practicals. These practical activities, integrated into the curriculum, provide students with hands-on experiences aligned with AQA's rigorous standards.

Starting in Year 10 and continuing through Year 11, the AQA Combined Science Trilogy curriculum incorporates specific practicals across Biology, Chemistry, and Physics. These required practicals are designed to deepen students' understanding of scientific concepts while honing their experimental skills.

For example, in Biology, students might conduct experiments related to topics such as enzymes, photosynthesis, or ecological sampling. In Chemistry, practicals cover areas like rates of reaction, electrolysis, and chromatography. Physics required practicals may include experiments on forces, waves, or electrical circuits.

These practical activities not only align with the AQA Combined Science Trilogy specifications but also contribute to the broader National Curriculum goals of fostering scientific inquiry and application. Students engage in planning, executing, and evaluating experiments, developing essential skills such as accurate measurement, data interpretation, and drawing valid conclusions.

The AQA Science Required Practicals ensure that students not only meet the theoretical demands of the GCSE curriculum but also gain proficiency in applying their knowledge through hands-on experimentation, preparing them thoroughly for both the written exams and the practical skills assessment at the GCSE level.

During GCSE AQA Combined Science Trilogy, students continue to build upon the foundation laid in Key Stage 3 (KS3) by further developing their scientific knowledge and skills across biology, chemistry, and physics.

1. Biology Progression:
    - KS3 Foundation: In KS3, students are introduced to basic biological concepts, progressing to more complex topics such as genetics and human biology.
    - GCSE AQA Combined Science Trilogy: The biology curriculum deepens, covering advanced topics like homeostasis, inheritance, and ecology. Cellular biology is explored in greater detail, including topics like cell division and the immune system.
2. Chemistry Advancement:
    - KS3 Foundation: In KS3, students establish fundamental principles of chemistry, progressing from atoms and elements to chemical reactions.
    - GCSE AQA Combined Science Trilogy: The chemistry curriculum advances, delving into organic chemistry, chemical analysis, and quantitative chemistry. Students develop a deeper understanding of periodicity, energy changes in reactions, and the properties of elements and compounds.
3. Physics Development:
    - KS3 Foundation: Physics in KS3 covers foundational concepts like forces, energy, and motion.
    - GCSE AQA Combined Science Trilogy: Physics at the GCSE level explores more complex topics such as waves, electricity, and magnetism. Atomic models and nuclear reactions are introduced, providing a more comprehensive understanding of the subject.
4. Practical Skills Enhancement:
    - KS3 Foundation: Practical skills in KS3 focus on basic experimental techniques, measurement, and data analysis.
    - GCSE AQA Combined Science Trilogy: AQA incorporates a range of required practicals to enhance experimental skills. Students engage in more sophisticated investigations, developing proficiency in data interpretation, evaluation, and drawing valid conclusions.
5. Integration of Scientific Disciplines:
    - KS3 Foundation: The National Curriculum encourages an interdisciplinary approach, showcasing the interconnected nature of biology, chemistry, and physics.
    - GCSE AQA Combined Science Trilogy: The integrated approach continues, with students applying knowledge from multiple disciplines to understand complex phenomena. This prepares them for more specialised study and real-world applications.
6. Inclusion of AQA Science Required Practicals:
    - KS3 Foundation: Practical work is integral, emphasising the importance of hands-on experience.

- GCSE AQA Combined Science Trilogy: The inclusion of AQA Science Required Practicals enhances practical skills, aligning with the National Curriculum's goals and preparing students for both written exams and practical skills assessments.

In summary, the progression from KS3 to GCSE AQA Combined Science Trilogy involves a deepening and broadening of scientific knowledge, incorporating advanced concepts, more sophisticated practical skills, and a continued emphasis on interdisciplinary understanding. This evolution prepares students for a comprehensive understanding of science as they move into more specialised studies or practical applications.

Transitioning from Key Stage 3 (KS3) to GCSE AQA Separate Sciences involves a more in-depth exploration of biology, chemistry, and physics, as students focus on individual science disciplines rather than combined topics.

1. Biology Advancement:
   - KS3 Foundation: Students are introduced to basic biological concepts, progressing to more complex topics such as genetics and human biology.
   - GCSE AQA Separate Biology: The biology curriculum deepens further, encompassing advanced topics like homeostasis, inheritance, ecology, and more detailed cellular biology. Specific topics may include the nervous system, plant biology, and extensive coverage of human physiology.
2. Chemistry Progression:
   - KS3 Foundation: In KS3, students establish fundamental principles of chemistry, progressing from atoms and elements to chemical reactions.
   - GCSE AQA Separate Chemistry: The chemistry curriculum advances with a focus on detailed organic chemistry, chemical analysis, and quantitative chemistry. Topics like thermodynamics, chemical equilibrium, and advanced chemical concepts are explored in greater depth.
3. Physics Development:
   - KS3 Foundation: Physics in KS3 covers foundational concepts like forces, energy, and motion.
   - GCSE AQA Separate Physics: Physics at the GCSE level explores more complex topics such as waves, electricity, magnetism, and atomic models. Nuclear reactions and specialised topics like astrophysics may be introduced, providing a thorough understanding of physics principles.
4. Practical Skills Enhancement:

- KS3 Foundation: Practical skills in KS3 focus on basic experimental techniques, measurement, and data analysis.
- GCSE AQA Separate Sciences: AQA integrates required practicals tailored to each science discipline. Students engage in sophisticated investigations, honing their experimental skills with a focus on in-depth data interpretation, evaluation, and drawing valid conclusions.

5. Integration within Disciplines:
    - KS3 Foundation: The National Curriculum encourages an interdisciplinary approach, showcasing the interconnected nature of biology, chemistry, and physics.
    - GCSE AQA Separate Sciences: While each science is explored in isolation, students still develop an integrated understanding within each discipline. The in-depth study of specific topics prepares them for more specialised scientific pathways.
6. Inclusion of AQA Science Required Practicals:
    - KS3 Foundation: Practical work is integral, emphasising the importance of hands-on experience.
    - GCSE AQA Separate Sciences: AQA incorporates required practicals into each separate science, ensuring students develop advanced practical skills tailored to their chosen discipline. This aligns with the National Curriculum's goals and prepares students for written exams and practical assessments.

In summary, the transition to GCSE AQA Separate Sciences involves a deepening of scientific knowledge within each discipline, an increased focus on specialised topics, and advanced practical skills. This prepares students for a more in-depth exploration of their chosen science disciplines and for future studies or applications in specific scientific fields.

What skills and knowledge do students bring with them into A Level?

In addition to the previous list of skills and knowledge (which will continually be revisited and reinforced), students should also now be able to:

Biology

Moving from AQA GCSE Biology to Edexcel Salters Nuffield A Level (SNAB) represents a significant progression into advanced biological study. Here's how knowledge and skills developed in AQA GCSE Biology provide a foundation for A Level study:

1. Biology Specialisation:
    - AQA GCSE Biology: Establishes a fundamental understanding of biological concepts, including cellular biology, genetics, and ecology.
    - Edexcel Salters Nuffield A Level Biology: Extends this foundation with more specialized topics such as biochemistry, physiology, and molecular biology. Students engage in in-depth analyses, experiments, and critical evaluations of complex biological processes.
2. Practical Skills Advancement:
    - AQA GCSE Biology: Equips students with essential practical skills through required experiments and investigations.
    - Edexcel Salters Nuffield A Level Biology: Advances practical skills with sophisticated experiments, promoting independent research and in-depth investigation. Students master advanced laboratory techniques, data analysis, and effective scientific communication.
3. Integration of Biological Knowledge:
    - AQA GCSE Biology: Introduces biological concepts separately but encourages an appreciation for their interconnectedness.
    - Edexcel Salters Nuffield A Level Biology: Emphasises a more integrated understanding, allowing students to apply principles from different biological disciplines to analyse intricate biological phenomena.

4. Critical Thinking and Independent Study:
    - AQA GCSE Biology: Develops critical thinking skills through the analysis and evaluation of biological concepts.
    - Edexcel Salters Nuffield A Level Biology: Elevates critical thinking through independent research, critical evaluation of scientific literature, and the development of original ideas. Students engage in more open-ended investigations, fostering a deeper understanding of complex biological systems.
5. Preparation for Higher Education and Careers in Biology:
    - AQA GCSE Biology: Lays a foundation for further study in biology.
    - Edexcel Salters Nuffield A Level Biology: Prepares students for university-level study or careers in advanced biological research, medicine, and other specialised fields. The A Level depth of understanding serves as a robust platform for future academic and professional pursuits in the field of biology.

In essence, the transition from AQA GCSE Biology to Edexcel Salters Nuffield A Level involves a deepening of biological knowledge, refinement of practical skills, and a shift towards more specialised and advanced biological study. This progression sets the stage for higher education or careers in the field of biology, providing a comprehensive and advanced understanding of biological principles.

Chemistry

Transitioning from AQA GCSE Chemistry to AQA A Level Chemistry marks a significant advancement into more complex and specialised chemical study. Here's how knowledge and skills developed in AQA GCSE Chemistry lay the foundation for A Level study:

1. Chemistry Specialisation:
    - AQA GCSE Chemistry: Establishes a fundamental understanding of chemical principles, including atomic structure, chemical reactions, and periodic trends.
    - AQA A Level Chemistry: Builds upon this foundation with more specialised and advanced topics such as thermodynamics, equilibrium, organic synthesis, and transition metal chemistry. Students delve into intricate chemical concepts, including quantum mechanics and spectroscopy.
2. Practical Skills Refinement:
    - AQA GCSE Chemistry: Equips students with essential practical skills through required experiments and investigations.

- AQA A Level Chemistry: Advances practical skills with sophisticated experiments, emphasising quantitative analysis, instrumental techniques, and independent research. Students refine their ability to design and execute experiments, interpret complex data, and draw insightful conclusions.

3. Integration of Chemical Knowledge:
   - AQA GCSE Chemistry: Introduces chemical concepts separately but encourages an appreciation for their interconnectedness.
   - AQA A Level Chemistry: Promotes a more integrated understanding, allowing students to apply principles from different areas of chemistry to solve complex problems. Organic, inorganic, and physical chemistry are explored in an interconnected manner.
4. Critical Thinking and Independent Study:
   - AQA GCSE Chemistry: Develops critical thinking skills through the analysis and evaluation of chemical concepts.
   - AQA A Level Chemistry: Elevates critical thinking through independent research, critical evaluation of scientific literature, and the development of original ideas. Students engage in more open-ended investigations, fostering a deeper understanding of complex chemical phenomena.
5. Preparation for Higher Education and Careers in Chemistry:
   - AQA GCSE Chemistry: Lays a foundation for further study in chemistry.
   - AQA A Level Chemistry: Prepares students for university-level study or careers in advanced chemical research, pharmaceuticals, materials science, and other specialised fields. The A Level depth of understanding serves as a robust platform for future academic and professional pursuits in the field of chemistry.

In essence, the transition from AQA GCSE Chemistry to AQA A Level Chemistry involves a deepening of chemical knowledge, refinement of practical skills, and a shift towards more specialised and advanced chemical study. This progression sets the stage for higher education or careers in the field of chemistry, providing a comprehensive and advanced understanding of chemical principles.

Physics

Moving from AQA GCSE Physics to AQA A Level Physics, especially with the Astrophysics optional module, signifies a substantial advancement into more intricate and specialised physics study. Here's how knowledge and skills developed in AQA GCSE Physics establish the groundwork for A Level study:

1. Physics Specialisation:
    - AQA GCSE Physics: Establishes a fundamental understanding of physics principles, covering topics like forces, motion, electricity, magnetism, waves, and quantum physics.
    - AQA A Level Physics: Builds upon this foundation with more specialised and advanced topics such as mechanics, thermodynamics, electric and magnetic fields, nuclear physics, and quantum phenomena. The inclusion of the Astrophysics optional module introduces students to the complexities of the cosmos.
2. Practical Skills Refinement:
    - AQA GCSE Physics: Equips students with fundamental practical skills through required experiments and investigations.
    - AQA A Level Physics: Advances practical skills with sophisticated experiments, emphasising quantitative analysis, data interpretation, and independent research. The Astrophysics module introduces students to experimental techniques relevant to space science, fostering hands-on experience in this specialised field.
3. Integration of Physics Knowledge:
    - AQA GCSE Physics: Introduces physics concepts separately but encourages an appreciation for their interconnectedness.
    - AQA A Level Physics: Promotes a more integrated understanding, allowing students to apply principles from different areas of physics to analyse complex physical phenomena. The Astrophysics module integrates concepts from classical mechanics, electromagnetism, and quantum physics into the study of celestial bodies.
4. Critical Thinking and Independent Study:
    - AQA GCSE Physics: Develops critical thinking skills through the analysis and evaluation of physics concepts.
    - AQA A Level Physics: Elevates critical thinking through independent research, critical evaluation of scientific literature, and the development of original ideas. The Astrophysics module challenges students to think critically about the mysteries of the universe, fostering a deeper understanding of celestial phenomena.
5. Preparation for Higher Education and Careers in Physics:
    - AQA GCSE Physics: Lays a foundation for further study in physics.
    - AQA A Level Physics: Prepares students for university-level study or careers in advanced physics research, astrophysics, engineering, and other specialised fields. The Astrophysics module provides a unique perspective and skill set for those interested in the exploration of the universe.

In essence, the transition from AQA GCSE Physics to AQA A Level Physics, especially with the Astrophysics optional module, involves a deepening of physics knowledge, refinement of practical skills, and a shift towards more specialised and advanced physics study. This progression sets the stage for higher education or careers in the field of physics, providing a comprehensive and advanced understanding of physical principles, including the mysteries of astrophysics.

Experimental Skill

The development of experimental skills evolves progressively from Key Stage 3 (KS3) through Key Stage 4 (KS4) AQA Science and culminates in the CPAC (Core Practical Assessment and Competencies) qualification at Key Stage 5 (KS5). Here's an overview of the trajectory:

1. KS3 Science:
    - Introduction to Experimentation: In KS3, students are introduced to basic experimental skills. They learn to make accurate measurements, record data, and follow experimental procedures. Emphasis is on foundational skills like observation, data handling, and drawing conclusions.
2. KS4 AQA Science (GCSE):
    - Progression in Complexity: Moving into KS4, AQA Science (GCSE) builds on KS3 foundations. Experimental skills become more sophisticated, covering a range of scientific techniques. Students design and execute experiments independently, honing skills in precision, accuracy, and reliability. The AQA GCSE curriculum includes specific required practicals, ensuring students gain proficiency in key experimental competencies.
3. CPAC Qualification at KS5:
    - Advanced Experimental Competencies: At KS5, the CPAC qualification further refines experimental skills. Students engage in more complex experiments, often requiring a deeper understanding of theoretical concepts. The CPAC focuses on developing competencies essential for higher education and scientific research, such as designing investigations, data analysis, and critical evaluation of methods and results. There is also a huge importance placed on the student to analyse the risks of the experiments and how to manage them appropriately, with a risk assessment.
    - Independent Research Skills: CPAC encourages students to undertake independent research projects, fostering skills in project design, execution, and analysis. This prepares them for the demands of university-level study or scientific careers.

- Specialisation in Scientific Disciplines: The CPAC qualification recognises the diverse nature of scientific disciplines. It allows students to specialise in areas like biology, chemistry, or physics, tailoring their experimental skills to the specific requirements of their chosen field.
- Preparation for Higher Education and Careers: Successful completion of CPAC at KS5 not only demonstrates advanced experimental skills but also positions students for further study in scientific disciplines or careers that require a high level of experimental expertise.

In summary, the progression of experimental skills from KS3 through AQA Science at KS4 to the CPAC qualification at KS5 involves a continuous development of complexity, independence, and specialisation. This trajectory prepares students for the rigorous demands of higher education or professional pursuits in the sciences.

What will students study and when?

Year	Term 1	Term 2	Term 3
7	Building blocks of Chemistry, Separating Mixtures, Building blocks of life (cells), Contact forces	Reactions I, Life must go on (Reproduction), Never created never destroyed,	To infinity and beyond, Ecology, Our Earth, Sound, It's Electrifying
8	Body systems, Atmospheric chemistry, Thermal energy, Health & Lifestyle	Force fields, Light, Reactions II, Ecology 2, High Voltage	Periodic Properties, Genetics, Under pressure, Particles
9	Cars for the future, Ecosystem processes, Conductors and insulators, How reactive?, What a drag	Biology in technology and forensic detection, Uses of EM waves, Material chemistry	Reactions III, What a drag, Force fields II, Forensics (chemistry)
10	Combined - B1, B2, B3, C1, C2, C3, P1, P2, P3 Separate - B1, B2, B3, B4, C1, C2, C3, P1, P2, P3, P4	Combined – B4, B5, B6, C3, C4, C5, P4, P5, P6 Separate – B4, B5, B6, C4, C5, C6, P4, P5, P6	Combined – B7, B8, B9, B17, B18, C6, C7, P6, P7 Separate – B7, B8, B9, B17, B18, C7, P7, P8
11	Combined: B10, B11, B13, C7, C8, P10, P12, P13 Separate: B10, B11, B12, B13, C7 (review), C8, C9, C10, P9, P10, P11	Combined: B14, B15, B16, C9, C12, C13, C14, P13, P15, P8/9 (Review) Separate: B13, B14, B15, B16, C11, C12, C13, C1, P12, P13, P14, P15	Combined: B16, B18, C15, Revision Separate: B17/18 (Review), C15, P15, P16, Revision
12	**Biology** Teacher 1: Biological molecules, proteins and genetics Teacher 2: Lifestyle and disease, diet and health **Chemistry** Teacher 1: Atomic Structure, Amount of Substance and Bonding Teacher 2: Introduction to Organic Chemistry, Alkanes and Halogenoalkanes **Physics** Teacher 1: Particles and waves, Electricity 1	**Biology** Teacher 1: Cells, reproduction, variation Teacher 2: Gas exchange, cell membranes **Chemistry** Teacher 1: Energetics, Kinetics and Equilibria and Redox Group 2 and 7 Teacher 2: Alkenes and Alcohols and Organic Analysis **Physics** Teacher 1: Electricity, Materials Teacher 2: Forces and motion	**Biology** Teacher 1: Revision Teacher 2: Biodiversity, resources from plants, Ecosystems **Chemistry** Teacher 1: Optical Isomerism and the Carbonyl Group and Aromatic Chemistry Teacher 2: Further Synthesis and Analysis **Physics** Teacher 1: Circular motion, revision Teacher 2: Revision

	Teacher 2: Equations of motion, Forces in balance		
13	**Biology** Teacher 1: Photosynthesis, climate change and evolution Teacher 2: Forensics, microorganisms and immunity **Chemistry** Teacher 1: Rates and Kp, Thermodynamics, Teacher 2: Period 3 elements, Acids and Bases **Physics** Teacher 1: Thermal, Fields (Electric/Magnetic) Teacher 2: Gravitational fields	**Biology** Teacher 1: Muscles, exercise and respiration Teacher 2: Nervous system, the brain, behaviour and disease **Chemistry** Teacher 1: Transition Metals and Revision Teacher 2: Electrode Potential and Amines, amino acids, proteins and DNA **Physics** Teacher 1: Radioactivity, Nuclear energy Teacher 2: Astrophysics, Mass and energy (from nuclear energy topic)	**Biology** Teacher 1: Scientific Article and revision Teacher 2: Revision **Chemistry** Teacher 1: Revision Teacher 2: Revision **Physics** Teacher 1: Revision Teacher 2: Revision

What cross-curricular themes have been identified?

1. **Mathematics**:
    - KS3: Measurement and geometry skills applied in science experiments, such as calculating volumes and understanding geometric shapes.
    - KS4 and KS5: Advanced mathematical concepts employed in physics, for example, calculus in motion analysis or statistical analysis in biology experiments.
2. **Design and Technology:**
    - KS3: Application of science concepts in designing and creating simple machines or structures.
    - KS4 and KS5: Collaboration between science and design and technology in projects related to materials engineering or sustainable technologies.
3. **Geography**:
    - KS3: Studying ecosystems and biodiversity in science correlates with geographical concepts, such as understanding different environments and climate zones.
    - KS4 and KS5: Investigating the impact of climate change in both geography and science, exploring how physical processes and human activities contribute.
4. **Computing**:
    - KS3 to KS5: Using ICT tools for data analysis and simulations in science experiments, fostering computational thinking and digital literacy.
5. **English**:
    - KS3: Developing scientific literacy through reading and summarising articles or conveying experimental findings through written reports.
    - KS4 and KS5: Incorporating extended essays and presentations in science courses, refining communication skills for conveying complex scientific ideas.
6. **History**:
    - KS3: Exploring the historical context of scientific discoveries, such as understanding the impact of the Industrial Revolution on scientific advancements. The Chernobyl disaster and the political impact, covered in the radioactivity topic.

- KS4 and KS5: Examining the historical significance of events like the Apollo moon landing, the discovery of DNA's structure, or considering ethical implications in the development of medical technologies.

7. **Physical Education (PE)**:
   - KS3 to KS5: Applying knowledge of biomechanics and physiology in science to understand how the body responds to physical activity in PE lessons.
8. **CAPE**:
   - KS3 to KS5: Sexual reproduction covered in the CAPE curriculum links with animal reproduction in Science, however, Science focuses on the mechanics of reproduction and CAPE evolves this into relationships and feelings.
9. **Religious Studies:**
   - KS3 to KS5: Exploring the intersection of science and ethics, considering ethical dilemmas related to scientific advancements and technology. Discussing the ethical implications of scientific advancements, such as genetic engineering, stem cells, The Big Bang, within the context of religious education.
10. **Music and Drama:**
    - KS3 to KS5: Investigating the scientific principles behind sound and acoustics, integrating knowledge in music and drama performances or in the creation of scientific-themed artistic expressions.
11. **Sociology and Psychology:**
    - KS4 and KS5: Examining the societal impact of scientific developments, such as the influence of technology on human behaviour (Psychology) or exploring sociological perspectives on scientific advancements.

Literacy

Disciplinary literacy in the Science curriculum refers to the specialised skills and knowledge required to comprehend, analyse, and communicate within the field of science. It involves the development of literacy skills specific to scientific disciplines, enabling students to engage effectively with scientific texts, practices, and concepts. Here are key aspects of disciplinary literacy in the Science curriculum:

1. **Scientific Vocabulary and Terminology**:

- Across Educational Levels: Students are exposed to and expected to master the specific vocabulary and terminology relevant to each scientific discipline (biology, chemistry, physics). This includes understanding and using precise scientific language in reading, writing, and communication.

2. **Reading and Analysing Scientific Texts:**
   - Across Educational Levels: Emphasis on reading and interpreting a variety of scientific texts, such as research papers, articles, and experiment instructions. Students learn to extract information, identify main ideas, and critically evaluate scientific literature.
3. **Writing in Scientific Formats:**
   - Across Educational Levels: Developing the ability to communicate scientific ideas through various written formats, including lab reports, research papers, and essays. Students learn to structure scientific writing, present evidence, and draw conclusions.
4. **Data Analysis and Graphical Literacy:**
   - Across Educational Levels: Proficiency in interpreting and creating graphs, charts, and tables to represent scientific data accurately. Students learn to extract meaningful information, identify patterns, and draw conclusions from graphical representations.
5. **Experimental and Procedural Literacy:**
   - Across Educational Levels: Understanding and following experimental procedures, including the ability to read and comprehend complex experimental instructions. Students develop the literacy skills required to conduct experiments, analyse results, and draw conclusions.
6. **Critical Evaluation of Scientific Information:**
   - Across Educational Levels: Encouraging students to critically evaluate scientific information, considering the reliability of sources, experimental design, and the validity of scientific arguments. This involves developing the literacy skills necessary for scientific reasoning and critical thinking.
7. **Multimodal Literacy:**
   - Across Educational Levels: Engaging with scientific information presented in various formats, including multimedia, diagrams, and models. Students develop the ability to interpret and create multimodal representations of scientific concepts.
8. **Cross-Curricular Literacy Integration:**

- Across Educational Levels: Recognising the interconnections between science and other subjects, fostering literacy skills that allow students to navigate interdisciplinary content and understand how scientific knowledge intersects with various disciplines.

Disciplinary literacy in the Science curriculum is essential for preparing students to be scientifically literate citizens. It equips them with the skills needed to engage with the complexities of scientific information, contribute to scientific discussions, and make informed decisions in a rapidly evolving scientific landscape.

British Values

Rule of law

Genetic testing and genetic engineering as applications of science that have made a positive difference to people's lives. Discuss risks, benefits, ethical issues and regulations associated with gene technology.

Democracy

How have the laws come about, e.g., pressure from the public, politicians and media for safe products? Use of democratic process to enable or restrict scientific developments, e.g., methods of energy production, genetic engineering, development and use of chemicals

Tolerance and Mutual Respect

Tolerance and mutual respect of different faiths and beliefs and promotion of the Equality duty. The approaches to solving scientific problems that are part of GCSE Science qualifications require students to show tolerance and mutual respect in relation to: behaviour in the laboratory and classroom, creation of an effective working environment whether in a school or the workplace through tolerance and mutual respect, health and safety: implications of clothing and other items of religious significance, understanding of the influence of different faiths and beliefs in some decisions which impact on science and healthcare.

Individual liberty

Limitations on freedom through health and safety legislation and the rules of the laboratory to ensure safe practice. Career and education choices that students make and limitations on these freedoms, e.g., exam results. Individual freedom to accept or use life support in maintaining circulatory and respiratory systems. Individual freedoms to decide whether to donate organs for transplantation. Individual freedom to use or not use birth control, individual freedom to have genetic screening, individual lifestyle choices that influence health.

Are there any extra-curricular links, visits or speakers linked to units of work?

In addition to the extra-curriculum clubs running within the Science department which all students are welcome to attend, the following visits are organised yearly:

Year	Term 1	Term 2	Term 3
7		British Science Week – Use of resources to enhance learning in the classroom linked to yearly topic.	Royal Institution visit to do an energy in food show, relates to Y7 Energy lesson in Term 1 and Year 8 Respiration lessons. Planetarium show linked to Space topic.
8		British Science Week – Use of resources to enhance learning in the classroom linked to yearly topic .	Royal Institution visit to do an energy in food show, relates to Y7 Energy lesson in Term 1 and Year 8 Respiration lessons.
9		British Science Week – Use of resources to enhance learning in the classroom linked to yearly topic.	Forensics Day – an opportunity for students to apply all of their learnt knowledge from the academic year
10			
11		Intervention after school to support revision.	Speaker from the Institute of Astronomy for Triple Science links into P15 Space topic. Intervention after school to support revision.
12	Chemistry Olympiad – recovers all aspects of Y12 and will extend learning beyond the curriculum.	Biology Olympiad – recovers all aspects of Y12 and will extend learning beyond the curriculum.	Colchester Zoo Trip – links into evolution and conservation, with talks from experts
13	CERN – links into magnetic fields, electric fields, particles (Y12). Speaker Peter Tait – links into experimental Science.	Intervention after school to support revision.	Speaker from Institute of Astronomy to support Astrophysics module. Intervention after school to support revision.