The Science Curriculum at AJK

Why should all students learn your subject?
Human progress throughout history has largely rested on advances in science - from our knowledge of gravity to cutting-edge medicines, students of science have shaped our modern world. These advances can trace their origin back to individuals learning about science as pupils. That's why it is in the interests of governments, companies, and wider society to promote science as a subject at school; it ensures the next wave of progress in all the fields that affect our daily lives. A strong scientific understanding is imperative to understand the world in which we live.

The science curriculum is ambitious for all pupils, even the most complex scientific concepts can be accessed by all pupils with the right direction and practice. The curriculum is designed to teach the building blocks of biology, chemistry, and physics so that all that follows is set in context.

In biology this means teaching cell theory, the history of the cell and the contributions and innovation of scientists who made those discoveries and communicated them to the world. This progresses in a logical path towards the modern day, where CRISPR technology is analysed and the ethical and moral dilemmas surrounding the use of these technologies is debated.

The particle model is taught in depth so that pupils understand why materials possess their properties. Chemistry is taught from the discovery of elements as well as the periodic table with an understanding of sub-atomic particles to determine chemical property rather than the learning of those properties. In each discipline, the contemporary situation is considered and communicated to pupils so that the curriculum is not only relevant but also built-to-last, for example, when teaching microscopy, pupils learn about the most recent development in microscopy – the synchrotron institute, empowering and inspiring our pupils to work at the world's best institutions.

We teach a curriculum that is spiralled – this means that pupils revisit concepts with increasing complexity are they more through the key stages.

We follow the ARK Network Mastery Curriculum to deliver a rigorous curriculum, which inspires pupils and equips every child with the disciplinary knowledge to:

- Critically consume data (including media sources) and draw valid conclusions
- Be curious about their surroundings
- Undertake practical work safely and skilfully
- Communicate ideas and opinions scientifically
- Develop optimism and excitement for what science can do for people and the planet
- Understand the impact science can make on communities and society for social justice

What is the core substantive knowledge in your subject?

- Cell biology
- The Hierarchy of Life
- Ecosystems
- Genetics
- Chemical Structure & The Periodic Table
- Chemical Reactions
- Earth systems
- Forces & motion
- Gravity & magnetism
- Energy
- Electricity

How the curriculum is different at GCSE
The Combined Science: Trilogy GCSE is the core, compulsory science offer for all pupils. The Trilogy set of GCSEs gives pupils 2 GCSEs in science, however all three disciplines of biology, chemistry and physics are taught and examined. There are 21 required practical activities which are also assessed in the examinations with questions relating to these practicals accounting for 15% of marks.

Knowledge in Separate Sciences GCSE
There are some fascinating topics included when you opt for GCSEs in biology, chemistry and physics! In biology, you will study topics including the brain, eye and kidneys with increased opportunities for dissection, monoclonal antibodies and their medicinal use, plant diseases, cloning, genetics, ecology and farming. These topics fit particularly well with GCSE Geography.

In chemistry, you will learn about nanoparticles, polymerisation, amino acids, DNA, analytical chemistry, industrial methods and much more. This is an invaluable foundation for chemistry and a career in the medical, pharmaceutical or engineering professions.

In physics, you will study the additional topics of radioactive isotopes, nuclear fusion and fission, mechanics, waves, lenses, sound technology and the endlessly fascinating space physics!

Pupils carry out 28 required practicals. These are assessed in the examinations with questions relating to these practicals accounting for 15% of marks.

How do students practice in science?
In science lessons we learn scientific facts and practise these until we have mastery of them. We then apply our knowledge to increasing levels of complexity.
As we develop our understanding, we bring together the interlinked disciplines in science to demonstrate understanding of the interconnectedness of science, this is demonstrated through extended writing.

All AJK pupils have a depth and breadth of secure scientific knowledge. We have taught the core foundational knowledge, as well as the rich knowledge around the edges of the disciplines. This forms the springboard to further study, opening the doors for a bright future at A-Level and beyond.

Pupils will have mastered the required practical activities. They will apply their knowledge to different situations around these practicals in order to deepen their understanding of practical technique.

Science would not exist without communication; the development of scientific literacy takes the following forms:

- Robust approach to spelling, punctuation and grammar.
- Enrichment of vocabulary; we tackle the most challenging scientific vocabulary until it is known, for example, teaching binomial names of organisms and biological terms which are genuinely used in science, rather than reductive 'school versions'.
- Developing scientific writing in the academic style using the third-person passive voice and modelling this routinely using the visualiser to highlight good practice.
- We expose pupils to a large amount of reading material, this enables the story of science to be told for each discovery; allowing pupils to see where developments have come from and where they are going, this shows that science is continually evolving.

The Science Curriculum Overview			
Year	Autumn	Spring	Summer
7	• *The Scientific Method** • Cells • Particles • Forces • Reproduction	• Atoms, elements & compounds • Gravity • Feeding relationships	• Energy transfers • Mixtures • Electrical circuits
8	• Tissues & Organs • Acids & alkalis • Movement & pressure • Respiration & Photosynthesis	• Changing substances • Magnetism • The Diversity of Life • Earth systems	• Nutrition • Light
9	C1 Atomic structure C2 Periodic table B1 Cells & Organisation B2 Cell Division P1 Conservation & dissipation of energy P2 Energy transfer by heating	C3 Structure & bonding B3 Organisation & the digestive system B4 Organising animals & plants P3 Energy resources P6 Molecules & matter	C5 Chemical changes B9 Respiration B16 Adaptations, interdependence & competition P5 Electricity in the home P4 Electric circuits
10	C4 Chemical calculations C6 Electrolysis B5 Communicable diseases B6 Preventing & treating disease B7 Non-communicable diseases B8 Photosynthesis P2 Energy transfer by heating P6 Molecules & matter P7 Radioactivity *P16 Space Physics***	B10 The human nervous system B13 Reproduction C7 Energy Changes C9 Crude oil & fuels P8 Forces in Balance P9 Motion	C8 Rates & equilibrium B14 Variation & Evolution P10 Forces & motion P11 Force & Pressure
11	C11 The Earth's atmosphere	C10 Chemical analysis	Revision

	C12 The Earth's resources B15 Genetics and evolution B11 Hormonal coordination B12 Homeostasis B17 Organising an ecosystem B18 Biodiversity and ecosystems	P13 Electromagnetism P12 Waves P14 Light P15 Electromagnetism	Exam preparation
Biology A-Level			
12	• Biological molecules • Nucleic acids • Cell structure • Transport across cell membranes • Cell recognition & the immune system • Exchange • Mass transport	• DNA, genes & protein synthesis • Genetic diversity • Biodiversity • Photosynthesis • Respiration • Energy & ecosystems • Response to stimuli	• Nervous coordination & muscles • Homeostasis
13	• Inherited change • Populations and evolution • Populations in ecosystems	• Gene expression • Recombinant DNA technology	• Required practicals • Revision • Exam preparation
Chemistry A-Level			
12	• Atomic structure • Amount of substance • Bonding • Oxidation, reduction, redox • Periodicity • Group 2 & 7 elements • Energetics	• Introduction to organic chemistry • Alkanes • Halogenoalkanes • Alkenes • Kinetics • Equilibria	• Alcohols • Organic analysis • Thermodynamics • Kinetics • Equilibrium constant
13	• Electrode potential • Acids, bases & buffers • Periodicity 2 • Transition metals • Nomenclature and isomerism • Carbonyl group compounds • Amines • Aromatic chemistry • Amines	• Transition metals • Reactions of inorganic compounds • Organic synthesis & analysis • Polymerisation • Amino acids, proteins, DNA • Chromatography • Structure determination	• Required practicals • Revision • Exam preparation
Physics A-level			
12	Forces in equilibrium • On the move • Skills in AS Physics • Materials • Waves • Newton's laws of motion • Force & momentum • Work, energy, & power • Electric current	• Waves • Optics • Quantum phenomena • Mathematical skills • Electric current • DC circuits • Matter and radiation	• Quarks & leptons • Gravitational fields • Electric fields • Motion in a circle • Simple harmonic motion • Capacitors • Magnetic fields
13	• Gravitational fields • Capacitors • Magnetic fields • Electromagnetic induction • Radioactivity • Mathematical skills • Electric fields • Thermal physics • Gases	• Optional unit - Turning points	• Required practicals • Revision • Exam preparation

**The Scientific Method* content (disciplinary knowledge) is embedded within all scientific topics throughout the curriculum.

Separate Science Topics form additional content within units from Year 9-11, except for Space Physics** in Y11, which is Separate Science only.