

Science KS4 – Statement of Intent

“Nothing in life is to be feared, it is only to be understood. Now is the time to understand more, so we may fear less”- Marie Curie

At All Saints Academy we align our Science curriculum to our vision *“Living Well Together with Dignity, Faith and Hope”*. Scientific knowledge allows greater understanding of the world around us. Everything we know about the universe, from how trees reproduce to what makes up an atom, is the result of scientific research and experiment. Human progress throughout history has largely rested on advances in science -it is the greatest collaborative endeavour. Science contributes to the members of our community living well together and ensures that we have the opportunity to live a long and happy life. We use science to monitor our health, provide medicine to cure our diseases, and provide water and food for our basic needs. Science also makes life more fun, including sports, music and entertainment. The latest communication technology allows us to live well together by allowing us to communicate and celebrate our faith with people on the opposite side of our ever-changing globe. We strive to ensure that students leave us scientifically literate and use these skills throughout their life when composing dignified responses to scientific concepts in the wider world. We hope that all students leave the Academy with the minimum of a grade 4 which will open the door to the best opportunities in later life.

To facilitate *‘Living Well Together’* students will learn to embrace all disciplines within science; Biology, Physics and Chemistry. We will ensure students have no barriers to learning by providing all students with the opportunity to develop their investigative and practical skills within science. Students with SEND will be able to access suitably differentiated lessons which use a range of resources and techniques including audio and visual resources to aid their learning. All students will be provided with access to our online textbooks, which can be accessed from any internet enabled device, ensuring our Pupil Premium students have no barriers to learning. Students will be provided with revision aids in Year 11, to provide enough resources to facilitate study within the Academy and in their own homes. During assessment there will reasonable adjustments made, for example allowing extra time and the use of student support workers.

As they commence KS4, students will extend their KS3 Physics knowledge of energy and electricity. In Biology, they will continue to develop their knowledge of the cell theory, organ systems, health and disease and photosynthesis. To reinforce the foundation of disciplinary knowledge at KS3, students will carry out a range of core practical investigations which permeate through the syllabus. These provide students with practical skills required whether they wish to take up an A level course in science or other practical disciplines. Students will develop these practical skills throughout their KS4 studies as part of investigative work and core practical work.

In our Science curriculum, the disciplinary knowledge (working scientifically) is embedded within the substantive content (scientific knowledge) of biology, chemistry and physics. As stated in Ofsted's Research Review Series, this allows students to:

- Appreciate the nature of substantive knowledge by knowing evidence for it.
- Use disciplinary knowledge together with substantive knowledge to ask scientific questions and enquire.
- Recognise the power and limitations of science.

Year 10

Substantive Knowledge

Students in year 10 follow the AQA Trilogy syllabus. Students will investigate principles of Biology such as cell structures and the organisation of organisms, including the digestive system and transportation in the blood. This leads on to the organic energy topics of respiration and photosynthesis. They study the transport of substances in and out of cells, as well as the processes which occur during cell division. Students will understand the differences between communicable and non-communicable diseases and how we are able to offer protection to the population through the development of vaccination, and they will understand the continued work within the world of medicine to prevent and treat these diseases.

In Chemistry, Students investigate the structure of the atom and the evidence that led to the creation of the models of the atom, and they will gain deeper understanding of the use of models in science to explain concepts that we are unable to observe directly. Students will learn about the need for atoms and ions to undergo bonding to become energetically stable.

In Physics, students investigate conservation and transfer of energy and the variety of energy sources available to us. In the final part of the term, students build on the topic of electrical circuits. They will utilise their key stage 3 knowledge as they draw a range of series and parallel circuits, with different components, and show the use of ammeters and voltmeters in series and parallel, as appropriate. Students will be introduced to the concept of radioactivity and will need to recall the structure of the atom from chemistry term 1, and use this knowledge to describe the structure of atoms following radioactive decay.

Disciplinary Knowledge

Students carry out several core practical activities which require them to make and record a variety of measurements. They will be fluent in the use of the terms reproducibility, reliability, precision and accuracy and will be able to explain the differences between them. In Biology, students begin with the topic of cells using microscopes to observe cells and draw scientifically accurate drawings of them. As part of their study of organ systems, students will carry out food tests on a range of different types of food. They will relate their microscope work to the calculation of cell sizes from drawings. Students will explore the gross structure of the heart by carrying out a dissection using animal tissue and collecting photographic evidence. Students will be designing and carrying out practical work with enzymes, investigating a range of independent variables.

Mathematical principles will be used to calculate a range of values such as relative formula mass and relative isotopic mass.

Students will watch demonstrations of the reactions of the alkali metals with water and use these to predict the reactions of other metals in the group. Students will formulate hypotheses when carrying out practical work with fundamental reaction types and students should become fluent in the use of more complex symbol equations to represent reactants and products of reactions. Students will carry out a range of core practical activities such as reaction time, making salts, electrolysis and energy changes.

The topic of electricity uses a variety of models to understand the types of electrical circuits, the components within circuits and the uses of these circuits in the domestic setting. Students will construct series and parallel circuits incorporating ammeters and voltmeters in the appropriate manner. As part of their studies on forces and motion, students will investigate speed and acceleration, using equations to calculate values for these quantities.

Year 11

Students in year 11 follow the AQA Trilogy syllabus. Year 11 prepares our students for their GCSEs by consolidating the topics that have been developed over the course of their time at the Academy. Students have a range of assessment points throughout the year with periods of reflection to identify strengths and weaknesses in their knowledge. Students can attend period 6 interventions or independent study. Our aim is that the students should be scientifically literate on leaving the Academy so that they may be confident in evaluating scientific ideas throughout their lifetime and draw sensible conclusions for themselves. To support students of all abilities and SEND students, we use a variety of fully resourced online textbooks. These textbooks support students as they progress through skills in both theory and practical science. In addition, the textbooks also challenge our HA students. Time is allowed at the end of the year to ensure that a thorough programme of revision is undertaken with a range of resources including audio-visual sources to ensure that the needs of PP, SEND and HA learners are met.

Substantive Knowledge

Plant biology is studied more extensively in Year 11, firstly with students investigating the factors which affect the rate of photosynthesis. Retrieval tasks will use content from Year 10 biology where students have learnt about specialised cells and the difference between plant and animal cells. Students will move on to learning about animal and plant coordination and homeostasis and will gain an understanding of the disease of diabetes and its management. Retrieval tasks will include testing for reducing sugars using the Benedict's test which was covered at the beginning of year 10. Students will investigate the interdependence of organisms within ecosystems using tables of random numbers to design investigations to collect valid data within a range of habitats. They will also consider the impact of humans on our planet and how we can improve food security for the planet.

Higher level students taking triple science will study the topics from the triple science lessons in addition. In biology, students will understand how the eye works and how common problems of the eye can be treated. In addition to studying the basic principles of hormonal communication, students will relate the principles of homeostasis to the actions in the body. They will learn about

the gross structure of the kidney and how dialysis and kidney transplants are used to relieve symptomatic patients. They will also consider the impact of humans on our planet and how we can improve food security for the planet. Students will gain an insight into the history of genetics including the work of Charles Darwin.

Dynamic equilibrium always challenges even our HA students, but this topic is well-scaffolded by the online textbook and its associated resources. Although students will be familiar with the basic qualitative chemistry throughout the course, the moles and masses topic reflects the content within the equilibrium topic and many of the examples used within lessons will be based on reversible reactions to ensure that our students are thoroughly fluent in manipulation of the values in calculations and the factors affecting the yield of reversible reactions. These skills are also used within the topic of fuels and earth science, the final topic before our students sit their GCSE examinations.

In addition to studying the chemistry of the alkanes in the triple science content, students will investigate the properties and uses of the alkenes and the chemistry of alcohols, carboxylic acids and esters. Students studying triple science will study analytical techniques in more detail than our combined students. These students will also learn about Earth resources and how they can be useful to us in both the laboratory and industrial situations and how we can control the conditions of chemical reactions to improve the yield of a product.

In physics, students will link their knowledge of graphs to the analysis of motion graphs.. They will study the solar system and look at the wider universe. Students will revisit the topic of electricity and electromagnets and focus on the motor effect which is a particularly challenging concept. There is an opportunity to learn more about waves and the electromagnetic spectrum and the uses and hazards of radiation of the electromagnetic spectrum.

Triple scientists will link their knowledge of waves to the uses of sound waves and ultrasound and the properties of seismic waves. Students will revisit the topic of electricity and use their existing knowledge to understand how transformers work and how they are used in everyday life. Students will learn about lenses in topic P14 light and their use in optical instruments.

Disciplinary Knowledge

Over the year, students will carry out a range of core practical activities using both hands on experience and multimedia experiences. These core skills will develop across the course and students will be required to identify independent, dependent and control variables and will be examined on these during examinations. Students will focus on collecting data that is reliable and repeatable. They will also consolidate their understanding of the terms accuracy and precision. In Biology, students investigate the effect of light intensity on photosynthesis during their work in B9. Later in the year, students will investigate respiration rate and use quadrats and random sampling methods to investigate abundance of organisms. They will also collect data about abiotic factors. In Chemistry, students will investigate combustion reactions and use analytical techniques. Students will also interpret chromatograms and gain information to make calculations of R_f values, And relate this to identification of unknowns. In Physics, students will build on their Key Stage 3 knowledge of electricity and magnetism, as well as the use of the ripple tank for investigating waves.

Students may be offered the opportunity to use data logging equipment to measure the effects of forces.