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.

Research informed practice in STEM (Science)

The Science curriculum has disciplinary knowledge, known as working scientifically within science, at its heart in KS3 lessons. As highlighted in the Science Biology chapter in *Huh* (Mary Myatt and John Tomsett), students' weakest area from KS2 Science is 'working scientifically' due to a lack of specialist equipment at KS2. Our lessons therefore ensure that working scientific skills can be developed throughout the curriculum, not just as skills learnt in a practical, but instead working scientific skill lessons are weaved into our curriculum to teach students disciplinary practices, such as drawing graphs, validating experimental data or using a thermometer as supported by the Osted Research Framework. At KS3, topics are organised according to major scientific principles called 'Big Ideas' which are threads that run across all KS3. As stated in Ofsted's Science Research Review, 'expert pupils organise their knowledge according to major scientific principles' therefore 'pupils need their knowledge to be organised around the most important scientific concepts, which predict and explain the largest number of phenomena'. The Big Ideas covered at KS3 are Forces, Electromagnets, Energy, Waves, Matter, Reactions, Earth, Organisms, Ecosystems and Genes.

Specific support planned for SEND students:

Tasks in science are broken down into green, amber and red levels of challenge. Students are able to select an activity that is at the appropriate level, and progress on to the next stage when ready. For longer written tasks students are given a writing frame and word banks to help support SEND needs. Learning mats are used in class; these help to support students and remind them of key concepts.

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 study the Edexcel syllabus for science. 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 structure of xylem and phloem and the processes of transpiration and mass flow. 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 move on to study exchange and transport in animals and will investigate the gross structure of the heart and discover how the circulatory and breathing system work in unison to carry out their function students will revisit the topics of transport in and out of cells and tissues and organs and this content will be recalled in retrieval tasks. 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.

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 physics, students will investigate the uses and problems of using radioactivity and will be reminded of the concept of using radiation in medicine when the benefits outweigh the risks. 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. Students will build upon their knowledge of the basic principles of the particle model to include density, gas pressure, and specific and latent heat.

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 topic 6. 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 carry out the process of electrolysis when learning about the extraction of metals and this provides a direct link to the process of phytomining. Students will also measure the rate of a chemical reaction by using the collection of gas method or observing the change of colour. In Physics, students will build on their Key Stage 3 knowledge of electricity and magnetism, investigating resistance as one of their core practical activities. They will also investigate

measuring density as part of the particle model topic. Students will be offered the opportunity to use data logging equipment to measure the effects of forces.