Curriculum Intent of SCIENCE

September 2021

KS3 Science

Intent

Science is a fundamental part of our everyday lives. It helps to explain so much of the world around us and enables advances in many areas including health, communication, the environment and leisure. The aim of KS3 is to allow pupils to find out more about the world around them, to develop an interest and understanding of natural phenomena and prepare them for studying Science at Key stage 4.

The KS3 Science curriculum at Wexham School will ensure that all pupils develop scientific knowledge and conceptual understanding through the specific disciplines of Biology, Chemistry and Physics. It will enable students to develop understanding of the nature, processes and methods of Science through different types of Science enquiries that help them to answer scientific questions about the world around them. It will enable all students to be equipped with the scientific knowledge required to understand the uses and implications of Science, today and for their future.

Knowledge

It is vitally important that students develop secure understanding of each key block of knowledge and concepts in order to progress to the next stage.

Students should be able to describe key processes and key characteristics in common language, and also be familiar with, and use, scientific terminology accurately and precisely. They will apply their mathematical knowledge to their understanding of Science, including collecting, presenting and analysing data. The social and economic implications of Science will be explored through the use of different contexts that maximise students' engagement with and motivation to study science.

Students will develop a deeper understanding of a range of scientific ideas in the subject disciplines of Biology, Chemistry and Physics and begin to see the connections between these subject areas and become aware of some of the big ideas underpinning scientific knowledge and understanding.

Skills

Students will develop the attitudes of a Scientist and so be able to:

- Pay attention to scientific skills showing accuracy, precision, repeatability and reproducibility
- Understand that scientific methods and theories develop as earlier explanations that are modified to take account of new evidence and ideas, together with the importance of publishing results and peer reviewing work.
- Evaluate risks and identify anomalies.

Students will build experimental skills and become adept at conducting investigations. As a result they will:

- Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience.
- Make predictions using scientific knowledge and understanding.
- Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate.
- Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety with a clear risk assessment in place.
- Make and record observations and measurements using a range of methods for different investigations; and evaluate the reliability of methods and suggest possible improvements.
- Apply sampling techniques

Students will become confident in the analysis and evaluation of Science, so that they can:

- Apply mathematical concepts and calculate results
- Present observations and data using appropriate methods, including tables and graphs

- Interpret observations and data, including identifying patterns/trends and using observations, measurements and data to draw conclusions.
- Present reasoned explanations, including explaining data in relation to predictions and hypotheses
- Evaluate data, showing awareness of potential sources of random and systematic error
- Identify further questions arising from their results.

Students will develop a range of skills around measurement practice in Science, therefore they will:

- Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature.
- Use and derive simple equations and carry out appropriate calculations
- Undertake basic data analysis including simple statistical techniques

'Working scientifically' is described separately at the beginning of the programme of study but must always be taught through and clearly related to substantive science content in the programme of study. Teachers should feel free to choose examples that serve a variety of purposes, from showing how scientific ideas have developed historically to reflecting modern developments in Science.

KS4 Science

Intent

At key stage 4 the core ideas which have been delivered at key stage 3 are developed further. In addition new topics are delivered which are tailored to the needs of the student's ability and cultural diversity.

Students progress from learners of science at key stage 3 to becoming career scientists, which allows them to encompass the role of science in their future. Demarcation of this allows studying the sciences in key stage 4 to provide the platform for either more advanced studies or for formal study of subjects that provide the foundations for understanding the natural world and an increasingly technological society.

All students are taught the essential aspects of the knowledge, methods, processes and uses of science. Key ideas in science will continue to be delivered in terms of the use of conceptual models and theories to make sense of the observed diversity of natural phenomena. The assumption that every effect has one or more cause. That change is driven by interactions between different objects and systems. That many such interactions occur over a distance and over time. That science progresses through a cycle of hypothesis, practical experimentation, observation, theory development and review. That quantitative analysis is a central element both of many theories and of scientific methods of inquiry.

The sciences should be taught in ways that ensure students have the knowledge to enable them to develop curiosity about the natural world, insight into working scientifically, and appreciation of the relevance of science to their everyday lives.

Students should develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics. With emphasis on developing understanding of the nature, processes and methods of science, through different types of scientific enquiry that help them to answer scientific questions about the world around them. Developing and learn to apply observational, practical, modelling, enquiry, problem-solving skills and mathematical skills, both in the laboratory, in the field and in other environments. Develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively.

Knowledge

Biology is the science of living organisms (including animals, plants, fungi and microorganisms) and their interactions with each other and the environment. The study of biology involves collecting and interpreting information about the natural world to identify patterns and relate possible cause and effect. Biology is used to help humans improve their own lives and to understand the world around them. Students should be helped to understand how, through the ideas of biology, the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas which are of universal application.

Chemistry is the science of the composition, structure, properties and reactions of matter, understood in terms of atoms, atomic particles and the way they are arranged and link together. It is concerned with the synthesis, formulation, analysis and characteristic properties of substances and materials of all kinds. Students should be helped to appreciate the achievements of chemistry in showing how the complex and diverse phenomena of both the natural and man-made worlds can be described in terms of a number of key ideas which are of universal application.

Physics is the science of the fundamental concepts of field, force, radiation and particle structures, which are inter-linked to form unified models of the behaviour of the material universe. From such models, a wide range of ideas, from the broadest issue of the development of the universe over time to the numerous and detailed ways in which new technologies may be invented, have emerged. These have enriched both our basic understanding of, and our many adaptations to, our material environment. Students should be helped to understand how, through the ideas of physics, the complex and diverse phenomena of the natural world can be described in terms of a number of key ideas which are of universal application.

Skills

Scientific enquiry develops the skills in science which are essential to the understanding of concepts in science and the development of new ideas. The areas are detailed as below:

1. The development of scientific thinking

2. Experimental skills and strategies

3. Analysis and evaluation

4. Vocabulary, units, symbols and nomenclature

KS5 Science

Intent

A-level Biology is a stepping-stone to further study of a variety of subjects at university. The course inspires students to understand the living world and nurture a passion for Biology. It also gives the groundwork for further study of courses such as Biological Sciences, Medicine, Dentistry and Veterinary science.

The content of Biology is covers numerous areas which allow students to develop their knowledge from a molecular basis to functioning organisms. Along with the importance of the dynamics of ecosystems to maintain life.

A level Chemistry allows students to grasp the core concepts required for the future study of pure Chemistry and Biochemistry. It also supplements application to access the study of Medical based courses at university.

The content of Chemistry brings together concepts in areas of Physical, Inorganic and Organic Chemistry. The cross teaching of year 1 and 2 topics in these areas allows students to understand the depth and breadth of the subject. Mathematical skills are also developed over the course leading to students becoming competent in dealing with data from experiments.

A level Physics encompasses the study of familiar topics to start with such as Particles, Waves and Electricity. This leads students onto looking at and choosing specific areas of study such as Astrophysics, Medical physics, Electronics. Students can then make decisions as to the depth of study they wish to follow, leading onto the study of Pure Physics or more career-based degrees such as Engineering.

Mathematical skill and manipulation of apparatus and instruments are developed in the course. Accurate observations and recording of data are needed to record physical phenomena. Calculations using the relevant formula and methodology are important in comprehending ideas in physics.

Knowledge

A level Biology

The course covers areas of Biological Molecules, Cells, Organisms exchange substances with their environment, Genetic information, variation and relationships between organisms, Energy transfers in and between organisms, Organisms respond to changes in their internal and external environments, Genetics, populations, evolution and ecosystems and The control of gene expression

A level Chemistry

The course covers topics in areas of Physical, Inorganic and Organic Chemistry. Specific topics in Physical Chemistry may include atomic structure, amount of substance, bonding, energetics, kinetics, thermodynamics, rate equations, electrode potentials and electrochemical cells. For Inorganic chemistry Periodicity, Group 2 the alkaline earth metals, Group 7 the halogens, properties of Period 3 elements and their oxides, transition metals. For Organic chemistry Alkanes, halogenoalkanes, alkenes, alcohols, organic analysis, aldehydes and ketones, carboxylic acids and derivatives, amino acids and DNA.

A level Physics

The course covers specific in-depth study of Measurements and their errors Particles and radiation Waves Mechanics and energy Electricity Further mechanics and thermal physics Fields Nuclear physics. The students can then choose on option from Astrophysics Medical physics Engineering physics Turning points in physics Electronics

Skills

An imperative part of the course is developing practical common practical skills in science. Students carry out practical tasks which are then assessed according the 5 main competency areas. These areas include the ability to follows written procedures, apply investigative approaches and methods, safely use a range of practical equipment and materials, make, and record observations and carry out research. Students must demonstrate consistent competencies in these areas in order to be given a pass in their practical skill.