St. Wilfrid's
R.C. College

Science Curriculum

Excellentia per fidem,
per scientiam, per adiuvatum

Excellence through faith, learning and support

Year 7

Biology

In primary school, students have been introduced to a number of organ systems, and they will begin their year 7 science studies learning about cells, the building blocks of life. They will see how cells are organised into tissues, organs and then organ systems, and learn how scientists can view cells using microscopes. Students will then study specialised cells, and learn how two of these specialised cells, the sex cells, are involved in reproduction to give rise to living organisms. Pupils will then conclude year 7 by studying how these living organisms survive within an ecosystem.

Students will be able to use a microscope and set up a slide to view a specimen. They will be able to calculate magnification and produce a scientific drawing of cells. They will be able to construct paragraphs using biological terminology and debate the use of fertilisers and pesticides in industry.

Year 8

Biology

Students begin year 8 by building on their knowledge of the digestive system to learn how enzymes function within the system, and break down food. Students will gain knowledge of the breakdown of particular food groups, such as carbohydrates into glucose. Students will then study respiration, and see how this glucose reacts with oxygen to release energy. They will build on their knowledge of year 7 biology and study the circulatory and respiratory systems. The year will conclude with students learning about photosynthesis, and see how this biochemical reaction differs from respiration. Students will build upon their knowledge of reproduction from year 7, by learning how plants reproduce, and again comparing this to animal reproduction.

Students will make links to explain how organs and organ systems play a role in key processes such as digestion and respiration. They will plan an experiment to investigate the effect of exercise on respiration, and be able to record their results in a scientific format. Students will also carry out an ecological sampling practical, and develop their skills using quadrats to estimate a population size.

Year 9

Biology

Students already have an understanding of how living organisms reproduce, but module 1 of Year 9 aims to build on this by teaching them how genetic information is involved in reproduction. They will understand the structure of chromosomes and DNA, and why offspring do not look identical. They will also be able to predict inheritance of single traits and speak the language of genetics including appropriate use of all key words.
Module 2 focuses on health and disease, a topic that has not yet been fully covered at key stage 3. Built into this will be scientific skills such as investigation planning, graph reading and evaluation and debate. Module 3 will reintroduce the fundamentals of biology to build on their knowledge of the basics; cells, organs, organ systems and enzymes.

Students in year 9 will be able to draw and interpret genetic crosses and label the structure of DNA. They will be able to debate the topic of genetic engineering and write an extended answer using key genetic terminology. Students will be able to explain how antibiotic resistance arises and investigate the effectiveness of antimicrobial substances on bacterial growth using appropriate equipment.

Year 10

Biology

In year 10 students embark on their journey of GCSE Biology. They will use their fundamental knowledge of cells in KS3 to see how cells grow by mitosis. They will understand how we all begin from one single cell, and grow into full organisms. Students will study the science behind inheritance, and see how organisms have evolved through natural selection. They will see how genetic information can be altered by the processes of genetic engineering and selective breeding. Finally, students end their year 10 studies by focussing on health and disease.

Our intent is to develop scientific skills, literacy and numeracy skills to prepare students for GCSE examinations. Students will become practically competent, and question the world around them. We will allow their oracy skills to flourish, through the means of debate, while also being able to appreciate other points of view. We aim to build resilient young scientists who can reflect on their performance and learn from their mistakes.

Year 11

Biology

Year 11 is the final part of their GCSE journey. Students will revisit the concept of photosynthesis in greater depth, and link this to how plants grow. Students will then focus on how hormones control and coordinate the responses of organisms, particularly animals. They will then study the circulatory system, and learn about the key organs involved in maintaining bodily functions. The final topic focuses on ecosystems, and how nutrients are recycled through organisms and the environment to link biological processes together.

We want students to appreciate where all of the biology they have learned from previous years fits in to the bigger picture. They should be able to link together concepts from both KS3 and KS4. We also intend to develop them as mature young scientists, ready to send them off into the outside world with inquisitive young minds.

Year 12

Biology

Students will have studied a number of biological molecules throughout their key stage 3 and 4 modules, and year 12 biology starts by learning about the biochemical structures of these fundamental molecules. Students already have a basic concept of cells, but they will delve deeper into the organelles of cells and study brand new cellular structures such as the Golgi apparatus and the endoplasmic reticulum. The key concepts of biological molecules and cells will then be built upon in the rest of the topics, in which students will learn about the role of cells in immunity, gas exchange mass transport and cell division. Students will also meet new concepts, such as the exchange of gases in insects, DNA replication and enzyme inhibitors that can act as drugs.

Year 13

Biology

Students conclude their key stage 5 studies by learning about two of the most important biochemical reactions in biology, photosynthesis and respiration. All of the knowledge from previous years is utilised to study these reactions in depth. Students then study the survival of organisms, including plants and animals, and how they respond to stimuli. Students will further their knowledge of genetics by studying inheritance, gene expression and see how scientists can manipulate genes in gene technology. They will conclude their year 13 studies by building upon the concept of homeostasis, studied in year 11, and begin to prepare for their final examinations.

Year 7

Chemistry

Students are introduced to the core principles of chemistry, including particle theory, atoms elements & compounds, and basic separation techniques. In the acids and alkalis topic they will explore hazard symbols, the scientific method, how to risk assess, and the principle of concentration.

- Particles in solids, liquids and gases
- How atoms make up elements and compounds
- How to carry out a safe experiment

Year 8

Chemistry

Students will begin to explore the periodic table. They will learn how it was built, and how to gather information from it. They will also start to develop their chemical calculation skills through calculating relative formula mass. Through studying combustion they will enhance their idea of what occurs during a chemical reaction. In this module we will introduce the empirical formulae calculation by asking students to discover the formula of magnesium oxide. Finally, through looking at materials from the Earth, they will further understand the link between the fundamental ideas of chemistry and the materials and products they use every day.

- How to gather as much information as possible from the periodic table
- The advantages and disadvantages of the combustion reaction
- How we extract materials from the Earth and atmosphere, and why they are useful for their functions

Year 9

Chemistry

In Module 1 students will explore chemical reactions more deeply, in particular those involving metals.
In Module 2 students will develop their ability to communicate chemical reactions using word and symbol equations. They will also develop their practical skills by undertaking various experiments.
In Module 3 students will look at the three main types of substances, their bonding and their properties

- The reactions between metals and various other substances
- How to write word and symbol chemical equations
- The similarities and differences between ionic, covalent and metallic substances

Year 10

Chemistry

Students in Year 10 start studying GCSE science. In chemistry we begin by exploring particle theory and the states of matter. We investigate the differences between pure substances and mixtures, and how we can separate different mixtures. We then look further into atomic structure and the periodic table, and the bonding and properties of different substances.
Finally we study how acids react with different substances, and how we can separate ionic compounds using electrolysis.

- How to separate varieties of mixtures
- Atomic and electronic structure
- Chemical calculations
- Explaining the properties of ionic, covalent and metallic substances
- Writing word, symbol and ionic equations

Year 11

Chemistry

Continuing on the GCSE course, we link how metals' reactivity links to their method of extraction, and we evaluate the recycling of metals. We delve further into groups 1, 7 and 0 of the periodic table, and use displacement reactions to prove the reactivity of group 7 elements.
We use collision theory to explain how we can manipulate the rates of different reactions. We finish our studies by looking at how fuels are derived from crude oil, and the effect these fuels can have on our atmosphere.

- Linking metals' extraction to the reactivity series
- How reactivity links to periodic table position
- Collision theory
- Environmental impacts of fuel usage

Year 12

Chemistry

In year 12 we split the study of chemistry into three distinct disciplines.
Concepts that have been explored throughout KS3 and KS4 are revisited, such as bonding, rates of reaction, and organic compounds derived from crude oil.
Students' basic understanding of organic compounds is developed further using organic mechanisms to show the synthesis of different organic materials.
Our study of exothermic and endothermic reactions in year 11 is expanded to manipulating thermodynamic calculations to deduce enthalpy changes.
Our knowledge of atomic structure and the periodic table allows us to further explore the patterns of periodicity. This then lets us look further into the elements of group 2 and group 7.

Year 13

Chemistry

Students continue with their key stage 5 studies by building on their physical, organic and inorganic chemistry knowledge and understanding.
We add to our suite of organic mechanisms by focussing on the reactions of the aldehyde, ketone, carboxylic acid and amine functional groups. We also look at further ways we can deduce the structure of an organic molecule, using NMR and chromatography methods.
We develop our knowledge of the physical side of chemical reactions, including how we can manipulate the reactions of acidic substances, and how electrochemical cells work at an atomic level.
We also continue our inorganic studies by explaining the complex chemistry of the transition metals, and those elements in the third period of the periodic table.

Year 7

Physics

Students develop a basic understanding of core scientific skills and concepts. They learn to use simple mathematical equations to model physical processes and understand that to investigate the world you need to change one variable, measure another and keep all other variables constant

Students will look at the relationships between speed, distance and time to begin to develop skills of both drawing and analysing graphs of motion. The wave speed equation is also introduced to aid the use of mathematical equations in a number of physical situations. Retrieval of real life situations relating to states of matter is used to give some context to the new concept of particle theory.

Year 8

Physics

Continue to develop the basic understanding of core scientific skills and concepts. Learn to apply algebraic processes to mathematical modelling of physics concepts. Begin to develop an ability to apply physics concepts to decision making on a local, national and global basis. Students can graphically analyse experimental data.

Students should be able to build and construct simple series and parallel circuits with a good understanding of circuit components and their symbols. A deeper understanding of gravity, weight, air resistance and friction is developed. Students explore further details of the solar system and how the ways in which we have observed it has changed over time.

Year 9

Physics

Students build on their scientific understanding to a level where they can understand moderately complex scientific concepts with increasing levels of abstraction. Students can approach complex mathematical modelling in a systematic manner to draw correct conclusions. Students understand how to limit the error and uncertainty in an experiment.
Students begin to write up core practical's such as refraction to help develop skills in preparation for GCSE KS4 studies. A summary of the electromagnetic spectrum is produced to broaden the students knowledge about its uses/dangers and frequencies. Students build upon their prior knowledge of the particle model and learn about key concepts such as specific heat capacity and specific latent heat.

Year 10

Physics

Students develop their understanding of the physical universe to a level where they can understand complex scientific concepts, making links between concepts from different areas of the course. Students can approach complex mathematical modelling in a systematic manner to draw correct conclusions, with occasional support.

Students in Year 10 start studying GCSE science. In physics we continue to develop out understanding of 'Forces'. We investigate Newtons Laws in more depth including calculations involving momentum and impulse. We then look further into 'Energy', specifically in relation to moving vehicle and safety. We also deepen out understanding of radioactivity and the changing atomic model. Finally we study wave theory and make links to everyday applications such as waves in medicine.
Separate Scientists also study aspects of cosmology when looking at 'The Universe', drawing in other all aspects of the course.

Year 11

Physics

Students excel in understanding of the physical universe to a level where they can understand complex scientific concepts, making links between concepts from different areas of the course. Students can approach complex mathematical modelling in a systematic manner to draw correct conclusions. Students can qualitatively analyse the error and uncertainty in an experiment.

Continuing on the GCSE course, materials and their properties. We build on theoretical concepts to look at practical investigations such as Hookes Law and specific heat capacity. We delve further into electricity, looking at Ohms Law, transformers and the National Grid.
Throughout the course we build on key mathematical and physical skills and concepts – including mathematical manipulation of data, data analysis and practical skills.

Year 12

Physics

Y12 starts by embedding maths skills needed in A-level Physics such as specified fundamental (base) units of measurement. Practical work in the subject needs to be underpinned by an awareness of the nature of measurement errors and of their numerical treatment. Concepts that have been explored throughout KS3/KS4 are revisited, such as waves, mechanics and electricity and enhanced further. The relatively new content of particles introduces students both to the fundamental properties of matter, and to electromagnetic radiation and quantum phenomena whilst also re-examining the work done on radiation in KS4.

Year 13

Physics

The earlier study of mechanics is further advanced through a consideration of circular motion and simple harmonic motion (the harmonic oscillator). A further section allows the thermal properties of materials, the properties and nature of ideal gases, and the molecular kinetic theory to be studied in depth.
The ideas of gravitation, electrostatics and magnetic field theory are developed to emphasise one of the great unifying ideas in physics. Students are then made aware of the physics that underpins nuclear energy production and also of the impact that it can have on society. Finally we finish off with the optional module of Astrophysics where fundamental physical principles are applied to the study and interpretation of the Universe

GCSE Combined Science

Course: Edexcel GCSE Combined Science

Summary of papers/coursework and assessment objectives in table

Paper B1 = Written examination: 1 hour and 10 minutes
- 16.67% of the qualification
- 60 marks
- Covers topics B1, B2, B3, B4 and B5
- A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination.
- One 6 mark extended answer question

Paper B2 = Written examination: 1 hour and 10 minutes
- 16.67% of the qualification
- 60 marks
- Covers topics B1, B6, B7, B8 and B9
- A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination.
- One 6 mark extended answer question

Paper C1 = Written examination: 1 hour and 10 minutes
- 16.67% of the qualification
- 60 marks
- Covers chemistry topics 1, 2, 3, and 4
- A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination.
- One 6 mark extended answer question

Paper C2 = Written examination: 1 hour and 10 minutes
- 16.67% of the qualification
- 60 marks
- Covers chemistry topics 1, 6, 7 and 8
- A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination.
- One 6 mark extended answer question

GCSE Combined Science

Course: Edexcel GCSE Combined Science

Summary of papers/coursework and assessment objectives in table

Paper P1 = Written examination: 1 hour and 10 minutes • 16.67% of the qualification • 60 marks • Covers physics topics 1 - 6 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. • One 6 mark extended answer question
Paper P2 = Written examination: 1 hour and 10 minutes • 16.67% of the qualification • 60 marks • Covers physics topics 8, 9, 10, 12, 13, 14 and 15 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. • One 6 mark extended answer question

Overall course description

https://qualifications.pearson.com/en/qualifications/edexcel-gcses/sciences-2016.html#%2Ftab-CombinedScience

GCSE Biology

Course: Edexcel GCSE Biology

Summary of papers/coursework and assessment objectives in table

Paper 1 = Written examination: 1 hour and 45 minutes • 50% of the qualification • 100 marks • Covers topics B1, B2, B3, B4 and B5 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. • Two 6 mark extended answer question
Paper 2 = Written examination: 1 hour and 45 minutes • 50% of the qualification • 100 marks • Covers topics B1, B6, B7, B8 and B9 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. • Two 6 mark extended answer question

Overall course description

https://qualifications.pearson.com/en/qualifications/edexcel-gcses/sciences-2016.html#%2Ftab-Biology

GCSE Chemistry

Course: Edexcel GCSE Chemistry

Summary of papers/coursework and assessment objectives in table

Paper 1 = Written examination: 1 hour and 45 minutes • 50% of the qualification • 100 marks • Covers topics 1, 2, 3, 4 and 5 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. • Two 6 mark extended answer question
Paper 2 = Written examination: 1 hour and 45 minutes • 50% of the qualification • 100 marks • Covers topics 1, 6, 7, 8 and 9 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions. Calculators may be used in the examination. • Two 6 mark extended answer question

Overall course description

https://qualifications.pearson.com/en/qualifications/edexcel-gcses/sciences-2016.html#%2Ftab-Chemistry

GCSE Physics

Course: Edexcel GCSE Physics

Summary of papers/coursework and assessment objectives in table

Paper 1 = Written examination: 1 hour and 45 minutes • 50% of the qualification • 100 marks • Covers topics 1-7 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions.
Paper 2 = Written examination: 1 hour and 45 minutes • 50% of the qualification • 100 marks • Covers topics 1 and 8 - 15 • A mixture of different question styles, including multiple-choice questions, short answer questions, calculations and extended open-response questions.

Overall course description

https://qualifications.pearson.com/en/qualifications/edexcel-gcses/sciences-2016.html#%2Ftab-Physics

GCE Biology

Course: AQA GCE Biology

Summary of papers/coursework and assessment objectives in table

Paper 1: Written exam: 2 hours • Any content from topics 1–4, including relevant practical skills • 91 marks 76 marks: a mixture of short and long answer questions 15 marks: extended response questions • 35% of A-level
Paper 2: Written exam: 2 hours • Any content from topics 5–8, including relevant practical skills • 91 marks 76 marks: a mixture of short and long answer questions 15 marks: comprehension question • 35% of A-level
Paper 3: Written exam: 2 hours • Any content from topics 1–8, including relevant practical skills • 78 marks 38 marks: structured questions, including practical techniques 15 marks: critical analysis of given experimental data 25 marks: one essay from a choice of two titles • 30% of A-level

Overall course description

https://www.aqa.org.uk/subjects/science/as-and-a-level/biology-7401-7402

GCE Chemistry

Course: AQA GCE Chemistry

Summary of papers/coursework and assessment objectives in table

Paper 1: Written exam: 2 hours • Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 to 3.1.8 and 3.1.10 to 3.1.12 • Inorganic chemistry (section 3.2) • Relevant practical skills 105 marks of short and long answer questions 35% of A-level
Paper 2: Written exam: 2 hours • Relevant Physical chemistry topics (sections 3.1.2 to 3.1.6 and 3.1.9) • Organic chemistry (section 3.3) • Relevant practical skills 105 marks of short and long answer questions 35% of A-level
Paper 3: Written exam: 2 hours • Any content • Any practical skills 90 marks in total 40 marks of questions on practical techniques and data analysis 20 marks of questions testing across the specification 30 marks of multiple choice questions

Overall course description

https://www.aqa.org.uk/subjects/science/as-and-a-level/chemistry-7404-7405/specification-at-a-glance

GCE Physics

Course: AQA GCE Physics

Summary of papers/coursework and assessment objectives in table

Paper 1: Written exam: 2 hours • Any content from topics 1–5 and 6.1 (Periodic motion) • 85 marks • 60 marks of short and long answer questions and 25 multiple choice questions on content. • 34% of A-level
Paper 2: Written exam: 2 hours • Section 6.2 (Thermal Physics) and topic 7 and 8 • 85 marks • 60 marks of short and long answer questions and 25 multiple choice questions on content. • 34% of A-level
Paper 3: Written exam: 2 hours • Section A Compulsory section: Practical skills and data analysis • Section B: Students enter for **one** of sections 9, 10, 11, 12 or 13 • 80 marks • 45 marks of short and long answer questions on practical experiments and data analysis. • 35 marks of short and long answer questions on optional topic. • 32% of A-level

Overall course description

https://www.aqa.org.uk/subjects/science/as-and-a-level/physics-7407-7408