Curriculum: Science

KS3 Science Curriculum Intent

The national curriculum for science aims to ensure that all pupils:

- develop **scientific knowledge and conceptual understanding** through the specific disciplines of biology, chemistry and physics
- 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
- are equipped with the scientific knowledge required to understand the **uses, application and implications** of science, today and for the future.

Teaching and learning Overview:

Pupils follow a bespoke scheme of work designed by Woodhey Science Teachers, this is complemented with "Science Works" textbooks from Oxford University Press.

Pupils at Key Stage 3 each study 24 areas of Science (8 Biology topics, 8 Chemistry topics and 8 Physics topics) followed by bridging units to familiarise students with scientific content linked to knowledge and skills found more exclusively at key stage 4.

The curriculum implementation outlined below is just an outline of the topics studied by an 'average pupil'. These will be supported, adapted or extended as necessary for different abilities within the year group. Pupils are taught on a carousel to minimise practical equipment clashes and to accommodate shared classes, so it may be that your child is studying the topics in a different order to the example curriculum below.

Assessment Overview:

Assessment in Science during years 7, 8 & 9 will follow a common structure.
In the autumn term learners are assessed in each topic with approx. 30 minute examinations designed to test short term memory. Pupils should be given 1 weeks' notice. The examination will be carried out in lesson time and is based on SAT style questions which cover knowledge, numeracy, working scientifically and application skills.

In the spring term learners are assessed with a combined Science three topic examination lasting one hour which is designed to test longer term memory. Pupils will be given notice via the school examination calendar which is available on the website. The examination will be carried out in lesson time and is based on SAT style questions which again cover knowledge, numeracy, working scientifically and application.

In the summer term learners will be assessed in a variety of ways. These assessments may include classwork, homework and practical skill assessments.

Year 7 curriculum

Science is delivered on a carousel of disciplines where knowledge and skills are cumulative within and between subjects.

Term 1	**Term 2**	**Term 3**
<u>Welcome to science</u> • Lab safety • Apparatus • Measurements • The Bunsen burner <u>Biology module – Cells</u> Microscopy, Cells, Diffusion, Specialised cells, Tissues, Organs and Life processes, the human skeleton. <u>Chemistry module – Particles</u> Particle theory, properties of matter, state changes, expansion, melting and boiling, gas pressure, dissolving, <u>Physics module - Energy</u> Measuring energy, storing energy, GPE, chemical energy, fossil fuels, renewables, power stations, the energy crisis **Key Assessed Tasks:** **Chemistry – Boiling water** **End of unit assessments in each discipline**	<u>Biology module – Reproduction</u> Human reproductive systems, Fertilisation to embryo, inheritance of characteristics, types of behavior, puberty and female cycles, plant reproduction, seed dispersal <u>Chemistry module – Elements and compounds</u> The periodic table, classifying elements, metals and non-metals, compounds, chemical reactions, mixtures, is it pure? <u>Physics module - Forces</u> Types of forces, balanced forces? motion and forces, speed, friction, weight and mass, density, floating? **Key Assessed Task** **Biology – Puberty** **Chemistry – Metal or non-metal?** **Physics – Friction investigation** **Mini assessments every unit** **Summative assessment at end of term**	<u>Biology module – Classification</u> Species and classification, invertebrates and vertebrates, Classification keys, monitoring populations on land and in water, Plant classification <u>Chemistry module – Chemical reactions</u> What happens in a reaction? reversible or not? conservation of mass, combustion, other oxidations, decomposition, energy changes, catalysts, distillation and chromatography <u>Physics module - Space</u> Hemispheres, seasons, the moon and eclipses, the solar system, satellites, beyond the solar system, exploring space **Key Assessed Task** **Biology – Sampling** **Chemistry – Endo/Exo** **Physics – Eclipses in space** **Mini assessments every unit** **Summative assessment at end of term**

Year 8 curriculum

Term 1	**Term 2**	**Term 3**
<u>Biology module – Respiration</u> Defining respiration, ventilation and circulation, the heart, exercise and heart rate, anaerobic respiration <u>Chemistry module – Acids</u> What is pH, indicators, red cabbage, the pH scale, neutralization, making salt, acids and metals, using neutralization, <u>Physics module - Electricity</u> Static, insulators and conductors, current, safety, circuit symbols, potential difference, modelling circuits, design a torch, series or parallel, reisistance **Key Assessed Tasks:** **Biology – Exercise and heart rate** **Chemistry – Making salt** **Physics – Design a torch** **End of unit assessments in each discipline**	<u>Biology module – Digestion</u> Balanced diets and malnutrition, energy in food, food tests, down the pipe and out the other end, enzymes, intestine adaptations <u>Chemistry module – Inside materials</u> Atoms and Molecules, diffusion, under pressure, gas tests, the atmosphere, global warming, composite materials, recycling. <u>Physics module - Sound</u> What is sound? How loud, pitch, the ear, echoes, ultrasound, music to my ears, light vs sound. **Key Assessed Task** **Biology – Enzyme action** **Chemistry – Gas tests** **Physics – Echolocation** **Mini assessments every unit** **Summative assessment at end of term**	<u>Biology module – Microbes</u> What are the microbes? Using microbes, disease and transmission, human defence, vaccination, antibiotics, aseptic techniques, antibiotic resistance <u>Chemistry module – Periodic table</u> The elements, Introducing the first periodic table, metals or non-metal, group 1, group 7, group 0, reactivity patterns <u>Physics module - Light</u> Energy transfer, reflection, refraction, TIR, comparing waves, dispersion, visible light, seeing colour, the eyeball, the pinhole camera, the digital camera eye **Key Assessed Task** **Biology – Immunity** **Chemistry – Mendeleev's periodic table** **Physics – Reflection** **Mini assessments every unit** **Summative assessment at end of term**

Year 9 curriculum

Term 1	**Term 2**	**Term 3**
Biology module – Inheritance Genetics and DNA, mutation, types of variation, species, competition in pants, competition in animals, natural selection, Darwin's theory, extinction Chemistry module – Metal reactions Atoms, elements, compounds and molecules, metal properties, the reactivity series, metals and water, corrosion, metals and acid, oxidation, displacement in solutions, displacement in oxides Physics module - Forces Balanced or unbalanced, velocity/time graphs, falling, acceleration, levers, moments, air pressure, fluid pressure **Key Assessed Task** **Physics - Acceleration** **End of unit assessments in each discipline**	Biology module – Plants Photosynthesis, plant organs, food storage, transferring the energy, pyramids, bioaccumulation Chemistry module – Rocks Inside the Earth, tectonics, volcanoes, igneous rocks, metamorphic rocks, sedimentary rocks, weathering, chemical weathering, biological weathering, fossils, the rock re-cycle Physics module – Energy and Electromagnetism Heat or temperature, hot or cold, conduction, convection, radiation, efficiency, power, paying for electricity, magnetism, (&motors) **Key Assessed Task** **Biology – Photosynthesis** **Chemistry – The rock cycle** **Physics – the thermos flask**	CRASH – A STEM skills workshop tying scientific knowledge and understanding to the process of CSI investigations and skills of observation and reasoning Maths skills – Familiarising with the numeracy needed at GCSE, pupils study Standard form, Graphical representation, Resolution, Ratios and more on their journey to becoming number confident. Humans and society – What are drugs?, smoking and alcohol, medicinal and recreational drugs, drug testing, drug testing

Curriculum intent: GCSE science

Pupils study GCSE Science from AQA using bespoke schemes of work designed by Woodhey Science Teachers and this is complemented with "AQA GCSE Science" textbooks from Oxford University Press. All GCSE examinations for this course are taken in the summer term of year 11. Pupils will be awarded 2 GCSE grades (1-9).

KS4 Science Curriculum Intent:

Biology is the study of life with the following key ideas underpinning the content of the course

The fundamental units of living organisms are cells
Students will learn that some organisms are single celled organisms; some are multicellular and have many types of specialised cells. Students will understand the importance of how size of an organism affects surface area:volume ratios. They will be able to link this to adaptations that multicellular organisms have to maximise SA:V ratio

Life processes depend on molecules whose structure is related to their function – for example sugars, lipids, proteins and DNA
Students will learn how all life processes depend on biological molecules like sugars, lipids, DNA and proteins. They will understand how each molecule needs to be taken in, broken down and built up again (and in the case of DNA, inherited). They will be able to apply this to show how changes in these molecules may affect the functioning of the organism.

Life on Earth depends on photosynthesis
Students will learn that photosynthetic algae and all plants use photosynthesis to synthesise glucose. They will understand that this is then the primary building block of carbohydrates, proteins and lipids. They will be able to apply this to explain how the life of other organisms depends on this.

Organic compounds are used as fuels
Students will learn that sugars and more complex carbohydrates like starch are used as fuel in respiration. They will understand that this is a reaction that releases energy which can then drive the other chemical reactions necessary in all life forms.

Living organisms are grouped as species; each species adapts to their environment and is interdependent on other species in their ecosystem
Students will learn what Biologists define as a 'species'. They will understand that a variety of biotic and abiotic factors affect the diversity of species found in a particular community. They will be able to analyse factors that could affect the distribution of species in the environment.

Evolution occurs by natural selection
Students will learn that the survival of a species depends on the adaptations they possess and the environment in which they live. They will understand that those best suited to their environment will survive long enough to reproduce. They will be able to link this to the long term survival – or extinction – of the species.

An organism's genome helps it adapt to its environment
Students will learn that genes are the instruction manuals for building proteins. They will understand the importance of these proteins in terms of transport, metabolic reactions and structural functions. They will be able to link the structure of DNA to the formation of specific protein molecules.

Chemistry is the study of matter, its properties, how and why substances combine or separate to form other substances, and how substances interact with energy. The following key ideas underpin the course content.

Matter is made of particles called atoms
Everything is made up of atoms, which are made up of protons and neutrons (in the nucleus) and electrons (orbiting in shells). There are about 100 different types of naturally-occurring atoms called elements. Atoms of different elements have specific numbers of protons, neutrons and electrons, and this is what makes each element unique.

Elements show periodic relationships in their chemical and physical properties
Periodic relationships are the repeating patterns of properties based on *where* elements are found on the periodic table. Chemical properties are about how elements react with other elements. Physical properties are to do with melting and boiling points, mass and density. For example, Group 1 elements are solid metals which become *more* reactive down the group. Group 7 elements become *less* reactive down the group, while their melting and boiling points *increase* – they are gases at the top of the group and solid at the bottom! Understanding these relationships will help you to predict what reactions may happen in topics throughout Chemistry.

Periodic relationships can be explained by atomic structure
You can understand almost everything you need to know about periodic properties by getting to grips with how electrons are arranged in shells. The further down a group, the more shells an element has, and the further away the outer electrons are from the nucleus. Metals become *more* reactive as it becomes easier to *lose electrons* from the outer shell, while non-metals become *less* reactive down a group as it become harder to *gain electrons*.

Atoms bond by either transferring electrons or by sharing electrons
In ionic bonding, electrons are *transferred* from metals to non-metals. Metals *lose* electrons becoming positively charged ions, and non-metals *gain* electrons becoming negatively charged ions. In covalent bonding, electrons are *shared* between two non-metal atoms. The number of electrons shared depends on how many electrons each atom needs to have a full outer shell, and this can create single, double or even triple bonds.

The shapes of molecules and the way giant structures are arranged helps explain the way they behave
Think about the differences between diamond and graphite. Both are made up of carbon atoms only, but those carbon atoms are bonded and arranged in very different ways: this means that diamond is very hard and does not conduct electricity, while graphite is soft and is a good conductor. This key idea also comes up in organic Chemistry where we find that larger molecules result in higher boiling points.

Barriers to reaction mean reactions occur at different rates
In order for a reaction to happen, particles must collide with enough energy: this is called collision theory. Particles with more energy move faster and different reactant particles need different amounts of energy to make them react. That's why some reactions happen spontaneously while others need high temperatures to occur.

Chemical reactions take place via proton (H^+) transfer, electron transfer, or electron sharing
Proton transfer means the release of H^+ ions when *acids* react (H^+ ions are actually just protons). Reactions involving *electron transfer* are normally reactions between metals and non-metals to create ionic compounds. And reactions involving *electron sharing* will be reactions between two or more non-metals to create covalent compounds.

Energy is conserved in chemical reactions
Energy cannot be created, nor can it be destroyed, in chemical reactions. It is always conserved. Any energy that is released by a reaction will be absorbed by the surroundings (e.g. the water in a solution) and vice versa. This is closely linked to the idea that mass is conserved in chemical reactions.

Physics is the natural science that studies matter, its motion, and behavior through space and time, and that studies the related entities of energy and force. The following key ideas underpin the course content.

Models and theories
Scientific models and theories can be used to explain natural processes. For example, the particle model of matter can be used to explain why an ice cube which is heated enough will melt, but it can also explain where air pressure comes from, and why a balloon will burst if we pump it up too much. The law of conservation of energy allows us to calculate the speed at which a rollercoaster car will hit a loop-the-loop, but it can also be used to explain why the Moon is (very) gradually drifting further from the Earth.

Cause and effect
Every effect has at least one cause. Perhaps the best known example of this comes from Newton's third law of motion, which states that *for every (action) force there is an equal and opposite (reaction) force* – if I push the ground with my feet, the ground pushes me back. The effect of this interaction of forces is what we call a *jump*. A wave will travel down a Slinky spring when we move it at one end, and a change in the nucleus of an atom will lead to the emission of ionising radiation.

Difference and change
Differences between things are what cause changes to occur. A cell (or battery) can be used to apply a potential difference across a circuit, which can allow charges to flow around the circuit. Differences in air pressure are what cause winds to blow, and they allow animals (including us) to breathe. Differences in temperature cause a warm building to transfer thermal energy to its surroundings on a cold day.

Action at a distance
Some forces can act between two objects without physical contact. We call these non-contact forces. The gravitational force allows the Earth to orbit the Sun, a bar magnet can be used to pick up a steel paperclip from a distance of several centimetres, and a running Van de Graaff generator can give us an electric shock when we move a finger close to its dome.

The scientific method
Scientific ideas develop by making hypotheses, carrying out experiments, and developing or modifying theories as a result of these experiments.

The language of science
Laws and models which represent the world around us can be represented by using mathematics. This is what allows us to use science to predict things that we think might happen, such as by how many degrees the average global temperature will rise over the coming decades. Newton's second law ($F = ma$) allows us to explain why it is much more difficult to bring a lorry travelling at 60 mph to rest than a car which is travelling at the same speed. The mathematics which describes science also helps us develop new technologies and build things such as smartphones and MRI scanners.

In all KS4 groups, students are taught the 3 disciplines of science in parallel with specialist or experienced staff.

Specification content guidance can be found at:

Trilogy: https://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464

Separate Biology: https://www.aqa.org.uk/subjects/science/gcse/biology-8461

Separate Chemistry: https://www.aqa.org.uk/subjects/science/gcse/chemistry-8462

Separate Physics: https://www.aqa.org.uk/subjects/science/gcse/physics-8463

Year 10 trilogy/separate science delivery sequence*

Term 1	**Term 2**	**Term 3**
Biology B1 – Cells B2 - Organisation Chemistry C1 – Atomic structure and the periodic table C2 – Bonding, structure and the properties of matter Physics P1 – Energy	Biology B3 – Infection and response Chemistry C3 – Quantitative chemistry C5 – Chemical changes Physics P3 – Particle model of matter P4 – Atomic structure	Biology B4 – Bioenergetics B5 – Homeostasis (part 1) Chemistry C4 – Chemical changes C6 – Rate and extent of chemical change (part 1) Physics P2 – Electricity P5 – Forces (part 1)

Year 11 Trilogy/separate Science delivery sequence*

Term 1	**Term 2**	**Term 3**
Biology B5 – Homeostasis (part 2) B6 – Genetics and evolution Chemistry C6 – Rate and extent of chemical change (part 2) C7 – Organic chemistry C8 – Chemical analysis Physics P5 – Forces (part 2) P6 - Waves	Biology B7 – Ecology Chemistry C9 – Chemistry of the atmosphere C10 – Using resources Physics P7 – Magnetism and electromagnetism P8* - Space Physics Separate science only	Key ideas recap Final exam preparation (All subjects)

*Modules may span between terms dependent on timetable variations with individual classes.

KS4 Homework

Homework will be set by the class teacher twice per fortnight on average.

This may be:

- Further Science questions and practice of skills in exercise books.
- Research skills
- Making models
- Structured revision tasks
- Practical write up
- Learning key words
- Drawing diagrams
- Examination questions
- Sourcing practical equipment

Other useful information:

Key Stage 3: Textbooks:
Science Works 1 ISBN 978-0-19-915245-2 Link
https://drive.google.com/file/d/0B4Le0ZB-tgW0N3E5S0o2d0ZMR2M/view?usp=sharing

Science Works 2 ISBN 978-0-19-915250-6 Link
https://drive.google.com/file/d/0B4Le0ZB-tgW0ZmZRRXRrVTVwMnc/view?usp=sharing

Links to websites:

- **KS3 BBC Bitesize Science** http://www.bbc.co.uk/education/subjects/zng4d2p
- **KS3 Science** http://inteleducationresources.intel.co.uk/keystage3.aspx?id=80

Trilogy science assessment – All sciences

Exam Board	AQA	
Course Code	**8464**	
Course Title	GCSE Combined Science: Trilogy Specification http://www.aqa.org.uk/subjects/science/gcse/combined-science-trilogy-8464	
Tiers	Foundation	Grades 1-5 (Students failing to meet the minimum standard for grade 1 will be recorded as U).
	Higher	Grades 4-9 (Students failing to meet the minimum standard for grade 4 will be recorded as U).

Formal GCSE Assessment at the end of Year 11	**Details**	**Percentage of Qualification**
Paper 1 Biology Exam (Topics 1-4)	Written exam 1 Hour 15 minutes (70 marks) Summer Year 11.	16.7%
Paper 2 Biology Exam (Topics 5-7)	Written exam 1 Hour 15 minutes (70 marks) Summer Year 11.	16.7%
Paper 1 Chemistry Exam (Topics 8-12)	Written exam 1 Hour 15 minutes (70 marks) Summer Year 11.	16.7%
Paper 2 Chemistry Exam (Topics 13-17)	Written exam 1 Hour 15 minutes (70 marks) Summer Year 11.	16.7%
Paper 1 Physics Exam (Topics 18-21)	Written exam 1 Hour 15 minutes (70 marks) Summer Year 11.	16.7%
Paper 2 Physics Exam (Topics 22-24)	Written exam 1 Hour 15 minutes (100 marks) Summer Year 11.	16.7%

Separate Science Assessment

BIOLOGY curriculum

Overview: Pupils study GCSE Biology from AQA using bespoke schemes of work designed by Woodhey Science Teachers and this is complemented with "AQA GCSE Biology" textbooks from Oxford University Press.

Exam Board	AQA	
Course Code	**8461**	
Course Title	GCSE Biology	
Tiers	Foundation	Grades 1 – 5
	Higher	Grades 5 – 9

Specification http://www.aqa.org.uk/subjects/science/gcse/biology-8461

Style of formal GCSE Assessment	Details	Percentage of Qualification
Paper 1 Biology Exam Topics 1 – 4: Cell Biology; Organisation; Infection and Response; Bioenergetics	1 Hour 45 minute Exam 100 marks Summer Year 11.	50%
Paper 2 Biology Exam Topics 5 – 7: Homeostasis and Response; Inheritance, Variation and Evolution; Ecology	1 Hour 45 minute Exam 100 marks Summer Year 11.	50%

CHEMISTRY curriculum

Overview: Pupils study GCSE Chemistry from AQA using bespoke schemes of work designed by Woodhey Science Teachers and this is complemented with "AQA GCSE Chemistry" textbooks from Oxford University Press.

Exam Board	AQA	
Course Code	**8462**	
Course Title	GCSE Chemistry	
Tiers	Foundation	Grades 1 - 5
	Higher	Grades 5 - 9

Specification http://www.aqa.org.uk/subjects/science/gcse/chemistry-8462

Style of Assessment	Details	Percentage of Qualification
Unit 1 Chemistry 1 Exam (Topics 1-5)	1 Hour 45 Mins. Exam (100 marks) Summer Year 11.	50%
Unit 2 Chemistry 2 Exam (Topics 6-10)	1 Hour 45 Mins. Exam (100 marks) Summer Year 11.	50%

Physics curriculum

Overview: Pupils study GCSE Physics from AQA using bespoke schemes of work designed by Woodhey Science Teachers and this is complemented with "AQA GCSE Physics" textbooks from Oxford University Press.

Exam Board	AQA	
Course Code	**8463**	
Course Title	GCSE Physics	
Tiers	Foundation	Grades 1-5 (Students failing to meet the minimum standard for grade 1 will be recorded as U).
	Higher	Grades 4-9 (A grade 3 will be awarded were a pupil just fails to achieve a 4; below this standard a U will be recorded).

Specification http://www.aqa.org.uk/subjects/science/gcse/physics-8463

Style of Assessment	Details	Percentage of Qualification
Paper 1 Physics Exam (Topics 1-4)	Written exam 1 Hour 45 minutes (100 marks) Summer Year 11.	50%
Paper 2 Physics Exam (Topics 5-8)	Written exam 1 Hour 45 minutes (100 marks) Summer Year 11.	50%