Science Curriculum Intent

Key Stage 3

The intention of this curriculum is to ensure that all Future Academies students become scientifically literate individuals, able to recognise the importance of rational explanation, capable of scientific analysis and knowledgeable about the contribution that the sciences make to our theoretical and practical understanding of the world. The curriculum is designed so that foundational concepts are introduced at the outset and carefully built upon over three years; ensuring students develop an increasingly sophisticated and specialised understanding of the separate sciences. As such, students benefit from a coherent and cumulative curriculum that enables them to grasp increasingly specialised concepts and develop a rigorous understanding of scientific knowledge. Each long term, students will cover one topic from biology, chemistry and physics. There is a strong focus on retrieval practice and interleaving learning: each topic begins by explicitly returning to relevant prior learning and ends with an assessment and an interleaved test based on another topic. A practical skills assessment is placed at the end of the unit to enable students to connect their learning to a set of practical techniques and real-world applications. All-too-often learning about science involves a series of disjointed lessons and unconnected information that is difficult to remember or fully understand. As such, a key principle of this curriculum is that the sciences can and should be taught through meaningful narratives that enable students to form long-term memories. This is seen through the explicit, planned-for links between relevant topics and an emphasis, where relevant, on the chronological development of scientific discoveries and theories and their cultural importance. The purpose of the 3 year Key stage 3 is to prepare students for Key stage 4

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
7	**Cells**: Cell structure Microscopy Specialisation/differentiation Stem cells Organisation Mitosis **Particles** Atomic structure and states of matter physical changes and state symbols	**Particles** Separating mixtures: filtration and evaporation Separating mixtures: chromatography. **Energy** Energy stores and systems Energy transfers Conservation/dissipation Heat transfer and temperature Renewable and non-renewable resources	**The human body** Diffusion Digestion Digestive enzymes The heart Blood vessels **Atoms** Atoms/elements/compounds and mixtures Mass/charge atom Development of the atomic model	**Atoms** The periodic table The development of the periodic table Electronic structure Groups 1/7/0 **Forces** Contact/non-contact Gravity Resultant forces Forces and elasticity Speed	**Ecology** Communities Biotic/abiotic factors Food chains Trophic levels Biomass **Acids and alkalis** Conservation of mass and chemical equations Acids/bases Salts	**Acids and alkalis** Neutralisation Strong and weak acids **Waves** Transverse and longitudinal waves Wave properties Sound waves Using waves for detection and exploration Electromagnetic waves.
8	**Health and disease** **Prokaryotes and eukaryotes** **Culturing/preventing microorganism growth** Coronary heart disease and health issues Lifestyle and disease, and cancer Communicable disease Human defence systems Vaccination, antibiotics and painkillers **Metals** Metals/non-metals Group 1 Metallic bonding Properties of metals and alloys Metal reactivity The reactions of metals and acids.	**Metals** Properties of metals and alloys Metal reactivity The reactions of metals **Motion** Resultant forces Work done and energy transfer Scalar and vector quantities Forces and motion (mass and acceleration)	**Reproduction** Mitosis Human reproduction Hormones in reproduction **Meiosis** Sexual and asexual reproduction Advantages and disadvantages of sexual asexual reproduction **Non-metals** Chemical bonding Covalent bonding	**Non-metals** Properties of small molecules and giant covalent structures Structure and bonding in carbon molecules. **Energy and matter** Energy changes in systems Particle model and changes in state Internal energy and energy transfers Particle model and pressure Pressure	**Genetics/inheritance** Chromosomes and DNA Inheritance Inherited disorders Sex determination Variation Genetics **Organic chemistry** Fuels Carbon compounds as fuels	**Organic chemistry** Alkanes and alkenes The reactions of alkenes and alcohols Polymers **Space** The solar system Planets, orbits and satellites The life cycle of a star Red shift

YEAR 9	TERM 1 AND 2	TERM 3 AND 4	TERM 5 AND 6
Biology	**Evolution** Classification Sexual and asexual reproduction Variation and adaptations Evolution Evidence for Evolution	**Plant biology** Osmosis Plant organ systems Plant disease Photosynthesis Transpiration	**Respiration** Gas Exchange Cellular Respiration Active Transport
Chemistry	**Ionic bonding** Groups 1, 7 and 0. The properties of transition metals Ions Ionic bonding The properties of ionic compounds	**Energy changes and rates of reaction** Conservation of mass and balanced chemical equations Percentage yield Exothermic and endothermic reactions Rates of reaction	**Chemical Analysis** Pure and Impure substances Chromatography Identification of common gases.
Physics	**Newtonian mechanics** Power and Efficiency Newton's 1st law Newton's 2nd law Newton's 3rd law Forces and braking Momentum	**Electricity** Electrical Circuits Electrical Charge and Current in Circuits Resistance and Voltage The Effect of the Length of a Wire on Current Domestic Uses of Electricity and Safety	**Magnetism and Electromagnetism** Magnetism Electromagnetism

Key Stage 4 Science Curriculum Overview

At Future Academies Watford we follow the AQA GCSE specifications. Students are offered a choice of studying the combined science course or choosing to study separate sciences, thus the science provision is of a 'broad and balanced' curriculum.

Our curriculum involves more than coverage of the National Curriculum / syllabus outcomes relating to the areas of Biology, Chemistry and Physics; but it also encompasses experiences of 'cultural capital, Social, Moral, Spiritual and Cultural experiences and knowledge of democracy and the rule of law.

Our curriculum aims to ensure that all Future Academy Watford students become scientifically literate who are able to recognise the importance of rational explanation, capable of scientific analysis and knowledgeable about the contribution that the sciences make to our theoretical and practical understanding of the world. It is designed so that foundational concepts are introduced at the outset and are carefully built upon over the first three years, ensuring students develop an increasingly sophisticated and specialised understanding of the separate sciences. As such, students benefit from a coherent and cumulative teaching programme that enables them to grasp increasingly specialised concepts and to develop a rigorous understanding of scientific knowledge.

The Future academies 8 habits and mode of delivery is continues at Future academies Watford ensuring that students always have a continuity of delivery and with the support of narratives that are the best that have been said and written in science.

Students are taught biology, chemistry and physics by separate subject specialists enabling students to cover one key topic every half term. There is a strong focus on retrieval practice and interleaving learning: each topic begins by explicitly returning to relevant prior learning and ends with an assessment and an interleaved test based on another topic. The KS4 are explicated taught within the course usually placed at the end of the teaching of the key knowledge to enable students to connect their learning to the practical techniques and real-world applications.

The key principle of our curriculum design is that that scientific knowledge is taught through meaningful narratives enabling students to form long-term memories. This is seen through the explicit, planned-for links between relevant topics and an emphasis, where relevant, on the chronological development of scientific discoveries and theories, and of their cultural importance.

The purpose of the Key Stage 4 curriculum is to prepare students for their next stage in education, whether it be in A Level studies or in apprenticeships.

Over a student's time at Future academies the curriculum is designed to prepare students to be scientifically literate, able to read process scientific material in the media and draw informed conclusions and have informed conversations in whatever company they find themselves in.

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
10 Combined science	**Cell biology** Cell structure transport in and out of cells. Cell division by mitosis stem cells. **Chemistry fundamentals** **Atomic structure and the Periodic table** Atomic structure and the development of the atom Describing the development of the periodic table and describing and explaining the patterns that can be seen **Energy** Energy stores and transfers.	**Principles of organisation** Digestion, enzymes Heart and circulation Plant tissues organs and systems. **Structure and bonding** Describing and explaining ionic and covalent bonding. Describing and explaining the process of electrolysis. **Quantitative chemistry** Using quantitative analysis to determine the formulae of compounds and the equations for reactions and use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions.	**Infection and response** Describing the transmission symptoms and treatment of a range of infections. Describing and explaining how the human body is protected from infection. Explaining how transmission of infection can be prevented. **Quantitative chemistry** Using quantitative analysis to determine the formulae of compounds and the equations for reactions and use quantitative methods to determine the purity of chemical samples and to monitor the yield from chemical reactions. **Particle model of matter**	**Bioenergetics** The processes of photosynthesis and respiration Nerves and reflex actions Describing how the nervous system works to control the human body. **Chemical changes** Reactivity of metals, extracting metals **Atomic structure and radiation** The uses and hazards of radiation and radioactive substances. Describing and explaining half-life.	**Homeostasis** Homeostatic mechanisms in humans. Hormones and reproduction Describing how hormones control the human body; and their role in reproduction. **Energy changes Endothermic and exothermic reactions** Investigating, describing and explaining the heating and cooling effects of a chemical reaction. **Atomic structure and radiation** The uses and hazards of radiation and radioactive substances. Describing and explaining half-life.	**Homeostasis** Homeostatic mechanisms in humans. Hormones and reproduction Describing how hormones control the human body; and their role in reproduction. **Energy changes Endothermic and exothermic reactions** Investigating, describing and explaining the heating and cooling effects of a chemical reaction. **Forces** Explaining forces and their effects, describing and explaining how forces are seen and used in everyday life. **Combined Science** **Biology**

		Electricity Circuits Series and parallel circuits explaining the different characteristics seen. Explaining how electricity is supplied to homes – domestic electricity. **Particle model of matter** Using the particle model to predict the behaviour of solids, liquids and gases. Measuring density. Changing state Specific heat capacity Latent Heat Energy transfers Energy resources Generating electricity	Using the particle model to predict the behaviour of solids, liquids and gases. Measuring density.			Targeted Revision **Chemistry** Targeted Revision **Physics** Targeted Revision
10 Triple science 3 lessons per week	**Cell biology** Cell structure transport in and out of cells. Cell division by mitosis stem cells. **Chemistry fundamentals Atomic structure and the Periodic table** Atomic structure and the development of the atom Describing the development of the periodic table and describing and explaining the patterns that can be seen **Energy** Energy stores and transfers.	**Principles of organisation** Digestion, enzymes Heart and circulation Plant tissues organs and systems. **Structure and bonding** Describing and explaining ionic and covalent bonding. Describing and explaining the process of electrolysis. **Quantitative chemistry** Using quantitative analysis to determine the formulae of compounds and the equations for reactions and use quantitative methods to determine the Purity of chemical samples and to monitor the yield from chemical reactions. **Electricity** Circuits Series and parallel circuits explaining the different characteristics seen. Explaining how electricity is supplied to homes – domestic electricity. **Particle model of matter** Using the particle model to predict the behaviour of solids, liquids and gases. Measuring density. Changing state Specific heat capacity	**Infection and response** Describing the transmission symptoms and treatment of a range of infections. Describing and explaining how the human body is protected from infection. Explaining how transmission of infection can be prevented. Including plants **Quantitative chemistry** Using quantitative analysis to determine the formulae of compounds and the equations for reactions and use quantitative methods to determine the Purity of chemical samples and to monitor the yield from chemical reactions. **Particle model of matter** Using the particle model to predict the behaviour of solids, liquids and gases. Measuring density. Changing state Specific heat capacity Latent Heat Energy transfers Energy resources Generating electricity	**Bioenergetics** The processes of photosynthesis and respiration Nerves and reflex actions Describing how the nervous system works to control the human body. **Chemical changes** Reactivity of metals, extracting metals **Atomic structure and radiation** The uses and hazards of radiation and radioactive substances. Describing and explaining half-life.	**Homeostasis** Homeostatic mechanisms in humans. Hormones and reproduction Describing how hormones control the human body; and their role in reproduction. **Energy changes Endothermic and exothermic reactions** Investigating, describing and explaining the heating and cooling effects of a chemical reaction. **Atomic structure and radiation** The uses and hazards of radiation and radioactive substances. Describing and explaining half-life.	**Homeostasis** Homeostatic mechanisms in humans. Hormones and reproduction Describing how hormones control the human body; and their role in reproduction**.** **Energy changes Endothermic and exothermic reactions** Investigating, describing and explaining the heating and cooling effects of a chemical reaction. **Forces** Explaining forces and their effects, describing and explaining how forces are seen and used in everyday life. **Combined Science** **Biology** Targeted Revision **Chemistry** Targeted Revision **Physics** Targeted Revision

		Latent Heat Energy transfers Energy resources Generating electricity				
11 Combined science	**Biology** **Inheritance** Explain the process of fertilisation and how the genes give rise to the features of individuals. Explaining the symptoms prognosis and treatments of some inherited health conditions. **Rates of reaction** Describing and explaining the factors that affect the rate of a chemical reaction and explaining the effects that are seen. Explaining the applications of the science in industry **Forces** Explaining forces and their effects, describing and explaining how forces are seen and used in everyday life. Force and motion **<u>Mock Exam preparation</u>** **Combined Science** **Biology** Paper 1 revision Cell biology Organisation Infection and response Bioenergetics **Chemistry** Paper 1 revision **Energy changes** Chemistry of the atmosphere Bonding structure and properties of matter Quantitative chemistry Chemical changes **Physics** Paper 1 revision Energy Electricity Particle model of matter Atomic structure	**Combined Science** **Biology** **Inheritance and Evolution** Describing and explaining the process of evolution. Describing and explaining the process of selective breading, and genetic engineering. **Chemistry** **Organic chemistry** The chemistry and patterns of carbon chemistry, alkanes. Fractional distillation and the uses of the products of oil. **Chemical analysis** Using chemical reactions to identify the components of compounds. **Forces** Explaining forces and their effects, describing and explaining how forces are seen and used in everyday life. Force and motion	**Ecology** Exploring how humans are threatening biodiversity as well as the natural systems that support it Considering and describing and explaining some actions that need to be taken to ensure our future health, prosperity and well-being and the health of the world's environment. **Chemistry** **Chemistry of the atmosphere** Describing and explaining the development of the atmosphere over time **Physics** **Waves** Describing the characteristics of longitudinal and transverse waves. Naming the waves in the electromagnetic spectrum and explaining the uses and hazards of each of the waves.	**Chemistry** **Using resources** **Explaining how the properties of an material makes** **Physics** **Waves** Describing the characteristics of longitudinal and transverse waves. Naming the waves in the electromagnetic spectrum and explaining the uses and hazards of each of the waves. **Magnetism and electromagnetism.** Describing and explaining how magnets act, and their uses in everyday life. Explaining the magnetic effects of an electric current and the uses of electromagnets.	**Combined Science** **Biology** Targeted Revision **Chemistry** Targeted Revision **Physics** Targeted Revision **Combined Science** **Biology** **Paper 1 revision** Cell biology Organisation Infection and response Bioenergetics **Chemistry** **Paper 1 revision** Energy changes Chemistry of the atmosphere Bonding structure and properties of matter Quantitative chemistry Chemical changes **Physics** **Paper 1 revision** Energy Electricity Particle model of matter Atomic structure	**Combined Science** **Biology** **Paper 2 revision** Ecology Inheritance Homeostasis **Chemistry** **Paper 1 revision** Rates of reaction Organic chemistry Using resources Chemical analysis Chemistry of the atmosphere **Physics** **Paper 1 revision** Forces Waves Magnetism and electromagnetism

Year 11 triple science	**Combined Science** **Biology** **Inheritance** Explain the process of fertilisation and how the genes give rise to the features of individuals. Explaining the symptoms prognosis and treatments of some inherited health conditions. **Rates of reaction** Describing and explaining the factors that affect the rate of a chemical reaction and explaining the effects that are seen. Explaining the applications of the science in industry **Forces** Explaining forces and their effects, describing and explaining how forces are seen and used in everyday life. Force and motion **<u>Mock Exam preparation</u>** **Combined Science** **Biology** Paper 1 revision Cell biology Organisation Infection and response Bioenergetics **Chemistry** Paper 1 revision **Energy changes** Chemistry of the atmosphere Bonding structure and properties of matter Quantitative chemistry Chemical changes **Physics** Paper 1 revision Energy Electricity Particle model of matter Atomic structure	**Combined Science** **Biology** **Inheritance and Evolution** Describing and explaining the process of evolution. Describing and explaining the process of selective breading, and genetic engineering. **Chemistry** **Organic chemistry** The chemistry and patterns of carbon chemistry, alkanes. Fractional distillation and the uses of the products of oil. **Chemical analysis** Using chemical reactions to identify the components of compounds. **Forces** Explaining forces and their effects, describing and explaining how forces are seen and used in everyday life. Force and motion	**Ecology** Exploring how humans are threatening biodiversity as well as the natural systems that support it Considering and describing and explaining some actions that need to be taken to ensure our future health, prosperity and well-being and the health of the world's environment. **Chemistry** **Chemistry of the atmosphere** Describing and explaining the development of the atmosphere over time **Physics** **Waves** Describing the characteristics of longitudinal and transverse waves. Naming the waves in the electromagnetic spectrum and explaining the uses and hazards of each of the waves.	**Chemistry** **Using resources** **Explaining how the properties of an material makes** **Physics** **Waves** Describing the characteristics of longitudinal and transverse waves. Naming the waves in the electromagnetic spectrum and explaining the uses and hazards of each of the waves. **Magnetism and electromagnetism.** Describing and explaining how magnets act, and their uses in everyday life. Explaining the magnetic effects of an electric current and the uses of electromagnets. **Physics** **Space** Describing the origins and structure of the universe and our solar system. Explaining the life of a star. Describing and explaining the Red Shift phenomena.	**Biology** **Paper 1 revision** Cell biology Organisation Infection and response Bioenergetics **Chemistry** **Paper 1 revision** Energy changes Chemistry of the atmosphere Bonding structure and properties of matter Quantitative chemistry Chemical changes **Physics** **Paper 1 revision** Energy Electricity Particle model of matter Atomic structure	**Biology** **Paper 2 revision** Ecology Inheritance Homeostasis **Chemistry** **Paper 1 revision** Rates of reaction Organic chemistry Using resources Chemical analysis Chemistry of the atmosphere **Physics** **Paper 1 revision** Forces Waves Magnetism and electromagnetism

Key Stage 5 Science Curriculum Overview

At Future Academies Watford we follow the OCR Biology and chemistry specifications and AQA Physics and Applied science specifications. Students are offered a free choice as long as the entry requirements are met.

Our curriculum involves more than coverage of the National Curriculum / syllabus outcomes relating to the areas of Biology, Chemistry and Physics; but it also encompasses experiences of 'cultural capital, Social, Moral, Spiritual and Cultural experiences and knowledge of democracy and the rule of law.

Our curriculum aims to ensure that all Future Academy Watford students become scientifically literate who are able to recognise the importance of rational explanation, capable of scientific analysis and knowledgeable about the contribution that the sciences make to our theoretical and practical understanding of the world. It is designed so that foundational concepts are introduced at the outset and are carefully built upon over the first three years, ensuring students develop an increasingly sophisticated and specialised understanding of the separate sciences. As such, students benefit from a coherent and cumulative teaching programme that enables them to grasp increasingly specialised concepts and to develop a rigorous understanding of scientific knowledge.

The Future academies 8 habits and mode of delivery is continues at Future academies Watford ensuring that students always have a continuity of delivery and with the support of narratives that are the best that have been said and written in science.

Students are taught biology, chemistry and physics by separate subject specialists enabling students to cover one key topic every half term. There is a strong focus on retrieval practice and interleaving learning: each topic begins by explicitly returning to relevant prior learning and ends with an assessment and an interleaved test based on another topic. The KS4 are explicated taught within the course usually placed at the end of the teaching of the key knowledge to enable students to connect their learning to the practical techniques and real-world applications.

The key principle of our curriculum design is that that scientific knowledge is taught through meaningful narratives enabling students to form long-term memories. This is seen through the explicit, planned-for links between relevant topics and an emphasis, where relevant, on the chronological development of scientific discoveries and theories, and of their cultural importance.

The purpose of the Key Stage 5 curriculum is to prepare students for their next stage in education, whether it be at university work or in apprenticeships.

Key Stage Five Biology Curriculum Overview

	Autumn	Spring	Summer
YEAR 12 *OCR A*	**Module 2: Foundations in biology** • Cell structure • Biological molecules • Nucleotides and nucleic acids **Module 3: Exchange and transport** • Exchange surfaces • Transport in animals	**Module 2: Foundations in biology** • Enzymes • Biological membranes • Cell division, cell diversity and cellular organisation **Module 3: Exchange and transport** • Transport in plants	**Module 3: Exchange and transport** • Exchange surfaces • Transport in animals • Transport in plants **Module 4: Biodiversity, evolution and disease** • Communicable diseases, disease prevention and the immune system • Biodiversity • Classification and evolution

YEAR 13 *OCR A*	**Module 5: Communication, homeostasis and energy** • Photosynthesis • Respiration **Module 6: Genetics, evolution and ecosystems** • Cellular control • Patterns of inheritance	**Module 5: Communication, homeostasis and energy** • Communication and homeostasis • Excretion as an example of homeostatic control **Module 6: Genetics, evolution and ecosystems** • Manipulating genomes • Cloning and biotechnology	**Module 5: Communication, homeostasis and energy** • Neuronal communication • Hormonal communication • Plant and animal responses **Module 6: Genetics, evolution and ecosystems** • Ecosystems • Populations and sustainability *Targeted revision*

Key Stage Five Chemistry Curriculum Overview

	Autumn	Spring	Summer
YEAR 12 *OCR A*	**Foundations in chemistry** Atoms and reactions Compounds, formulae and equations Amount of substance Acids Redox Electron structure Bonding and structure	**Periodic table and energy** Periodicity Group 2 The halogens Qualitative analysis Enthalpy changes Reaction rates Chemical equilibrium	**Core organic chemistry** Basic concepts of organic chemistry Alkanes Alkenes Alcohols Haloalkanes Organic synthesis Analytical techniques
YEAR 13 *OCR A*	**Physical chemistry and transition elements** How fast? How far? Acids, bases and buffers Lattice enthalpy Enthalpy and entropy **Organic chemistry and analysis** Aromatic compounds Carbonyl compounds Carboxylic acids and esters Amines Amino acids, amides and chirality	**Organic chemistry and analysis** Polyesters and polyamides Carbon-carbon bond formation Organic synthesis Chromatography and qualitative analysis Spectroscopy **Physical chemistry and transition elements** Redox and electrode potentials Transition metals Qualitative analysis	*Targeted revision*

Key Stage Five Physics Curriculum Overview

	Autumn	Spring	Summer
YEAR 12 *AQA*	3.1 Measurement and their errors 3.2 Particles and radiation 3.4 Mechanics and materials	3.2 Particles and radiation 3.4 Mechanics and materials Waves Electricity	Waves Electricity
YEAR 13 *AQA*	Further mechanics and thermal physics Fields and their consequences	Nuclear physics Optional unit 9 Astrophysics (A-level only) 10 Medical physics (A-level only) 11 Engineering physics 12 Turning points in physics 13 Electronics	Targeted revision