



## Science

# CURRICULUM OVERVIEW – YEAR 11 (KS4)

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## Curriculum Overview

### Subject: KS4 Science

Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
11	C6- Chemical change CS- 10 hours SS- 10 hours	Particles Elements Molecules Compounds Activation energy Temperature Concentration Surface area Catalyst Collisions Reversible	<b>WS-</b> Recognise the importance of peer review of results  <b>Maths-</b> graphing skills including drawing, interpreting and determining intercepts  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions. Use of suffixes.	Understand that chemical reactions occur at vastly different rates. How different variables such as reactivity, surface area of substances can impact on these rates, understand that energy changes accompany chemical reactions and how this can be manipulated to provide maximum yield of desired products in industry.	6-mark mid-topic assessment  RP: Investigate changing concentrations on rate of reactions	Understanding social and ethical issues surround scientific technologies i.e. The Haber Process. Developing teamwork in analysing and extrapolating data to draw conclusions and becoming more numerically literate.	Factors that influence the rate of reaction: varying temperature or concentration, changing the surface area of a solid reactant or by adding a catalyst. Factors affecting reversible reactions.

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Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
11	P5- Forces CS- 8 hours SS- h12 ours	Forces Electrostatic Magnetic Gravity Vectors Work done Elastic Inelastic Stretching Hooke's Law Newton Pressure	<b>WS-</b> Presenting observations and other data using appropriate methods  <b>Maths-</b> recalling and applying relevant equations  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions	To understand that forces can be vector or scalar quantities, represented by arrows. Interactions between forces including weight, mass and gravity and how a number of forces acting on one object create a resultant force. Recognise the effect of different types of forces on objects using the three Newton Laws.	6-mark mid-topic assessment  RP: Investigate the relationship between force and spring extension  RP: The effect of force and mass on acceleration	Fairground ride designer, Mechanical engineer. Artificial limb development.	Forces as vectors. Calculating work done as force x distance; elastic and inelastic stretching. Pressure in fluids acts in all directions: variation in Earth's atmosphere with height, with depth for liquids, up-thrust force (qualitative). Interpreting quantitatively graphs of distance, time, and speed. Acceleration caused by forces; Newton's First Law. Weight and gravitational field strength. Decelerations and braking distances involved on roads, safety.

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11	B5- Homeostasis & response  CS- 13 hours SS- 20 hours	Nervous Coordination Control Reflex arc Neuron Synapse, Neurotransmitter Hormonal Coordination Hormones Target organs Glands Reproduction, Menstrual cycle Contraception Homeostasis	<b>WS-</b> Evaluating risks and benefits, explaining scientific technology applications in real life  <b>Maths-</b> Construct and interpret frequency tables and diagrams, bar charts and histograms  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions.	How the body requires a constant internal environment and control systems are in place to sense changes and bring about changes to maintain this. Recognise the structure and function of the nervous and hormonal systems. Explain how these systems coordinate and control the body's functions. Discuss the role of hormones in contraceptives and fertility treatments.	6-mark mid-topic assessment  RP: Investigating human reaction time	Understanding social and ethical issues surround scientific technologies. STEM careers	Principles of nervous coordination and control in humans. The relationship between the structure and function of the human nervous system. The relationship between structure and function in a reflex arc. Principles of hormonal coordination and control in humans. Hormones in human reproduction, hormonal and non-hormonal methods of contraception. Homeostasis.

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Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
11	C7- Organic chemistry CS- 9 hours SS- 17 hours	Carbon compounds Fuels Resources Fractional distillation Crude oil Cracking Extraction Purification Alkanes Alkenes Hydrocarbons Alcohols Carboxylic acids	<b>WS-</b> Using models, investigating properties of substances  <b>Maths-</b> visualise and represent 2D and 3D forms  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions. Use of prefixes.	Recognise that there are a variety of carbon compounds because carbon atoms can form chains and rings linked by C-C bonds. Sources of these carbon compounds include fossil fuels which are a major source of feedstock for the petrochemical industry. Recognise how Chemists can take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents.	6-mark mid-topic assessment	Making links to industries of perfumery and food. STEM careers.	Carbon compounds, both as fuels and feedstock, and the competing demands for limited resources. Fractional distillation of crude oil and cracking to make more useful materials.

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Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
11	C8- Chemical analysis  CS- 10 hours SS- 14 hours	Pure Impure Solute Solvent Solution Separation Filtration Crystallisation, Chromatography Mobile phase Stationary phase Fractional distillation Quantitative	<b>WS-</b> Plan experiments or devise procedures to make observations, produce or characterise a substance, test hypotheses, check data or explore phenomena.  <b>Maths-</b> recognise and use decimal form, ratios, fractions, percentages and estimates  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions.	Understand how analysts have developed a range of qualitative tests to detect specific chemicals. The tests are based on reactions that produce a gas with distinctive properties, or a colour change or an insoluble solid that appears as a precipitate. Understand how instruments can provide fast, sensitive and accurate means of analysing chemicals, and are particularly useful when the amount of chemical being analysed is small i.e. in forensic science.	6-mark mid-topic assessment  RP: investigate chromatography  RP: use chemical tests to investigate unknown ions	Using problem solving skills to determine which analytical tools are most appropriate. Exploring different fields of work where chemical analysis is key; tracing drugs in airport security, in the food industry preventing adverse reactions to preservatives and additives and forensic science.	Distinguishing between pure and impure substances, Separation techniques for mixtures of substances: filtration, crystallisation, chromatography, simple and fractional distillation. Quantitative interpretation of balanced equations. Concentrations of solutions in relation to mass of solute and volume of solvent.

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11	P6- Waves CS- 12 hours SS- 18 hours	Amplitude Wavelength Frequency Velocity Transverse Longitudinal Electromagnetic Vacuum Radio waves Gamma rays Absorption Reflection Refraction Microwave Infrared, Visible light Ultraviolet X-Ray Hazardous	<b>WS-</b> Evaluating risks and benefits, explaining scientific technology applications in real life  <b>Maths-</b> recognise expressions in decimal and standard form, change subject of equations, use angular measurements.  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions.	Recognise how wave behaviour is common in both natural and man-made systems. Waves carry energy from one place to another and can also carry information. Understand how modern technologies such as imaging and communication systems show how we can make the most of electromagnetic waves.	6-mark mid-topic assessment  RP: make observations of water and sound waves.  RP: investigate reflection and refraction of light. [triple only]  RP: investigate infrared radiation absorption	Understanding how waves behave and their application to different parts of life e.g., camera lenses, acoustic instruments, the human body. Studying the work of improved technologies over the years e.g., in scanning equipment	Amplitude, wavelength, frequency, relating velocity to frequency and wavelength. Transverse and longitudinal waves. Electromagnetic waves, velocity in vacuum; waves transferring energy; wavelengths and frequencies from radio to gamma-rays. Velocities differing between media: absorption, reflection, refraction effects. Uses in the radio, microwave, infra-red, visible, ultra-violet, X-ray and gamma ray regions, hazardous effects on bodily tissues.

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Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
11	B6- Inheritance, variation & evolution  CS- 18 hours SS- 23 hours	Genome Environment Phenotype Organism Gene Dominant Recessive Variation Populations Species Natural selection Evolution Classification Selective breeding Agriculture Biotechnology	<b>WS-</b> Explain every day and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.  <b>Maths-</b> understand probability, use fractions, ratios and number of significant figures  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions.	Understand how meiosis and sexual reproduction lead to variation in organisms. Often gene mutations occur but rarely cause harm. Recognise how scientists use their understanding of these processes to intervene in the production of livestock and plants with favoured characteristics. Evaluate the impact of genetic modification.	6-mark mid-topic assessment	Awareness of inherited diseases and symptoms/treatments. Understanding social and ethical issues surround scientific technologies. Biotechnology.	the genome as the entire genetic material of an organism. How the genome, and its interaction with the environment, influence the development of the phenotype of an organism. The potential impact of genomics on medicine. Most phenotypic features being the result of multiple, rather than single, genes. Single gene inheritance and single gene crosses with dominant and recessive phenotypes. Sex determination in humans. Genetic variation in populations of a species. The process of natural selection leading to the evidence for evolution. Developments in biology affecting classification. The importance of selective breeding of plants and animals in agriculture. The uses of modern biotechnology including gene technology.

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Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
11	P7- Magnetism & electromagnetism  CS- 8 hours SS- 12 hours	Magnetic fields Permanent Induced Compass Solenoids Transformers National grid Current Potential difference	<b>WS-</b> Interpret observations, diagrams and data to draw conclusions  <b>Maths-</b> recalling and applying relevant equations, changing the subject of equations  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions	Understand how electromagnetic effects are used in a wide variety of devices. How engineers make use of the fact that a magnet moving in a coil can produce electric current and also that when current flows around a magnet it can produce movement. Recognise that systems that involve control or communications can take full advantage electromagnets.	6-mark mid-topic assessment	Understanding social and ethical issues surround scientific technologies	

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11	C9- Chemistry of the atmosphere  CS- 10 hours SS- 10 hours	Atmosphere Composition Photosynthesis Absorb Climate change Global warming Greenhouse effect Infrared Nitrogen Oxygen Carbon dioxide Sediments Volcanic Compressed Fossil fuels Correlation Deforestation	<b>WS-</b> Understand how scientific methods and theories develop over time and appreciate the power and limitations of science and consider any ethical issues which may arise  <b>Maths-</b> ratios and fractions, interpreting graphical data  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions.	Recognise that the Earth's atmosphere is dynamic and forever changing. The causes of these changes are sometimes man-made and sometimes part of many natural cycles. Scientists monitor and predict weather and climate change as there are many variables that can influence this. Evaluate the problems caused by increased levels of air pollutants and the solutions developed to help reduce the impact of human activity.	6-mark mid-topic assessment	Recognising the importance of scientific developments in environmental chemistry to help prevent negative human impact. Improved awareness of the impact of humans and how individuals can contribute to making environmental improvements.	Evidence for composition and evolution of the Earth's atmosphere since its formation. Evidence, and uncertainties in evidence, for additional anthropogenic causes of climate change. Potential effects of, and mitigation of, increased levels of carbon dioxide and methane on the Earth's climate. Common atmospheric pollutants: sulphur dioxide, oxides of nitrogen, particulates and their sources. The Earth's water resources and obtaining potable water

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Year group	Topic and length	Key Words	Key Skills	Key Knowledge	Assessments	Cultural Capital	Links to NC and Spec
11	B7- Ecology CS- 18 hours SS- 24 hours	Organisation Ecosystem Abiotic Biotic Communities Sampling Microorganisms Decomposers Interdependent Adapted Environment Biodiversity Distribution Abundance Species Habitat Populations Quadrats	<b>WS-</b> Interpret diagrams, models and data to produce conclusions  <b>Maths-</b> handling data using a variety of methods  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions.	Recognise that the Sun is the source of energy for all life processes on Earth. Explain how ecosystems are composed with interdependence, adaptation and evolution of organisms. Evaluate human impact on biodiversity and how scientific research and development is used to maintain the Earth's biodiversity.	6-mark mid-topic assessment  RP: measure population size of organisms using appropriate sampling techniques  RP: Investigate the effect of temperature on decay [triple only]	Increasing awareness of how humans impact the environment. Exploring more of the local environment and how to respect.	Levels of organisation within an ecosystem. Some abiotic and biotic factors which affect communities, the importance of interactions between organisms in a community. How materials cycle through abiotic and biotic components of ecosystems. The role of microorganisms (decomposers) in the cycling of materials through an ecosystem. Organisms are interdependent and are adapted to their environment. The importance of biodiversity. Methods of identifying species and measuring distribution, frequency and abundance of species within a habitat. Positive and negative human interactions with ecosystems.

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11	C10- Using resources  CS- 10 hours SS- 16 hours	Natural resources Materials Sustainable Renewable Non-renewable Agriculture Synthetic Haber process Fertilisers Potable water Quarrying Recycling Landfill Corrosion Reactivity	<b>WS-</b> Translating data from one form to another  <b>Maths-</b> translate information between graphical and numeric form  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions. Use of prefixes.	Understand how industries use the Earth's natural resources to manufacture useful products. Chemists seek to minimise the use of limited resources, use of energy, waste and environmental impact in the manufacture of these products. This is termed life cycle assessment. Recognise that pollution, disposal of waste products and changing land use has a significant effect on the environment.	6-mark mid-topic assessment  RP: analysis and purification of water samples	Identifying parts of the local and national landscape which are useful in our everyday lives. Being solution-focussed to develop answers to everyday problems with certain resources being finite.	Life cycle assessment and recycling to assess environmental impacts associated with all the stages of a product's life. The viability of recycling of certain materials

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11	P8- Space physics [Triple only]  SS- 5 hours	Solar system Galaxy Stars Planets Moons Satellites Elliptical Asteroids Comets Fusion Nebula Centripetal Geostationary	<b>WS-</b> Evaluating risks and benefits, explaining scientific technology applications in real life  <b>Maths-</b>  <b>Communication &amp; Literacy-</b> Using scientific vocabulary, terminology and definitions. Use of prefixes.	Understand how in the past century, astronomers and astrophysicists have made remarkable progress in understanding the scale and structure of the universe, its evolution and that of humans. Recognise that new questions have emerged recently as our knowledge and understanding improves.	6-mark mid-topic assessment	Understanding social and ethical issues surround scientific technologies	The main features of the solar system.

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