

# Curriculum overview: Science (Foundation)

## Key Stage 2

### Living things and their habitats:

- Life cycles of a mammal, an amphibian, an insect and a bird
- Reproduction in some plants and animals.
- Classification into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals

### Animals:

- Describe changes as humans develop to old age
- Identify and name the main parts of the human circulatory system and describe the functions of the heart, blood vessels and blood
- Recognise the impact of diet, exercise, drugs and lifestyle on the way bodies function
- Describe the ways in which nutrients and water are transported within animals

### Properties and changes of materials:

- Compare and group together everyday materials on the basis of their properties, including their hardness, solubility, transparency, conductivity and response to magnets.
- Know that some materials will dissolve in liquid to form a solution, and describe how to recover a substance from a solution
- Use knowledge of solids, liquids and gases to decide how mixtures might be separated
- Explain and demonstrate reversible and irreversible changes

### Earth and Space:

- Describe the movement of the Earth, and other planets, relative to the Sun
- Describe the movement of the Moon relative to the Earth
- Use the idea of the Earth's rotation to explain day and night

### Forces:

- Explain that unsupported objects fall towards the Earth because of the forces of gravity
- Identify the effects of air and water resistance and friction
- Recognise that some mechanisms (levers, pulleys and gears) allow a smaller force to have a greater effect

### Evolution:

- Recognise living things have changes over time (studying fossils)
- Recognise that offspring can vary from their parents
- Identify how birds and animals are adapted to suit their environment

### Light:

- Recognise that light appears to travel in straight lines
- Explain how we see things
- Explain shadows

### Electricity:

- Explain voltage
- Use recognised symbols when representing a simple circuit

## Curriculum Overview

	Year 7	Year 8	Year 9	Year 10	Year 11
<b>BIOLOGY</b>	<ul style="list-style-type: none"> <li>▪ Describe the structure of different types of cells</li> <li>▪ Compare prokaryotic and eukaryotic cells</li> <li>▪ Correctly set up and use a microscope</li> <li>▪ Calculate magnification</li> <li>▪ Explain the specialisation of some cells such as; nerve, root hair, gametes</li> </ul>	<ul style="list-style-type: none"> <li>▪ Describe and explain specific and non-specific immune responses</li> <li>▪ Describe different types of pathogens and the implications they can have on the working of the body and cells</li> <li>▪ Explain how vaccination works</li> <li>▪ Describe the function of antibiotics linked to pathogens</li> </ul>	<p><b>Cell biology</b></p> <ul style="list-style-type: none"> <li>▪ Required practical: Plant and animal cells</li> <li>▪ Eukaryotic and prokaryotic cells</li> <li>▪ Microscopy</li> <li>▪ Cell specialisation</li> <li>▪ Differentiation and stem cells</li> <li>▪ Mitosis</li> <li>▪ Diffusion</li> </ul>	<p><b>Bioenergetics</b></p> <ul style="list-style-type: none"> <li>▪ Photosynthesis</li> <li>▪ Limiting factors of photosynthesis</li> <li>▪ Required practical: light and photosynthesis</li> <li>▪ Adaptations and using glucose</li> <li>▪ Respiration</li> <li>▪ Anaerobic respiration</li> </ul>	<p><b>Inheritance, variation &amp; Evolution</b></p> <ul style="list-style-type: none"> <li>▪ Sexual and asexual reproduction</li> <li>▪ Meiosis</li> <li>▪ DNA structure</li> <li>▪ Inheritance – test cross</li> <li>▪ Inheritance – other examples</li> <li>▪ Sex determination</li> </ul>

	<ul style="list-style-type: none"> <li>and ciliated</li> <li>▪ Compare and contrast the processes of diffusion and osmosis in biological examples</li> <li>▪ Body systems;</li> <li>▪ Describe the structure of cells and tissues in the body</li> <li>▪ Explain the function of enzymes and the digestive system</li> <li>▪ Label and explain the functions of the heart</li> <li>▪ Describe gaseous exchange</li> <li>▪ Describe how reflexes work using understanding of the nervous system</li> <li>▪ Compare and contrast aerobic and anaerobic respiration</li> <li>▪ Recall the main structure of plant tissues and organs</li> <li>▪ Describe adaptations of leaves, and link this to external factors such as weather, pollination and predation</li> <li>▪ Explain the process of photosynthesis</li> <li>▪ Evaluate the factors that can affect the rate of photosynthesis; both natural and man-made</li> </ul>	<ul style="list-style-type: none"> <li>▪ Describe resistance to pathogens</li> <li>▪ Recall the structures of the reproductive organs of males and females</li> <li>▪ Describe the functions of sex cells in males and females, including the process of fertilisation</li> <li>▪ Explain the stages of the menstrual cycle</li> <li>▪ Describe variation of a species</li> <li>▪ Explain how selective breeding works, and why it is done</li> <li>▪ Recall the fundamentals of genetics and inheritance; such as punnet square diagrams, genotypes and phenotypes</li> <li>▪ Describe how different organisms can compete, and what for</li> <li>▪ Describe adaptations of organisms to suit their habitat and function</li> <li>▪ Explain the theory of natural selection and evolution- link this to characteristics and extinction</li> <li>▪ Explain feeding relationships of groups of organisms</li> <li>▪ Explain how organisms can be sampled</li> <li>▪ Recall the stages of the water cycle</li> <li>▪ Explain how water and land can be biologically polluted</li> <li>▪ Describe deforestation; reasons and consequences</li> <li>▪ Link aspects of biological progresses to global warming</li> </ul>	<ul style="list-style-type: none"> <li>▪ Required practical: osmosis</li> <li>▪ Active transport</li> <li>▪ Exchanging materials</li> <li><b><u>Organisation</u></b> <ul style="list-style-type: none"> <li>▪ Principles of organisation</li> <li>▪ Digestive system</li> </ul> </li> <li>▪ Required practical: chemistry of food</li> <li>▪ Enzymes</li> <li>▪ Required practical: enzymes</li> <li>▪ Efficiency of digestion</li> <li>▪ Heart and circulation</li> <li>▪ Blood</li> <li>▪ Blood vessels</li> <li>▪ Coronary heart disease</li> <li>▪ Smoking, alcohol and diet</li> <li>▪ Lifestyle</li> <li>▪ Cancer</li> <li>▪ Lungs and gas exchange</li> <li>▪ Plans tissues and organs</li> <li>▪ Transpiration</li> <li><b><u>Infection &amp; Response</u></b> <ul style="list-style-type: none"> <li>▪ Communicable diseases</li> <li>▪ Protist diseases – malaria</li> <li>▪ First line of defence</li> <li>▪ Second line of defence</li> <li>▪ Vaccination</li> <li>▪ MRSA</li> <li>▪ Antibiotics and painkillers</li> <li>▪ Discovery and development of drugs</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Exercise</li> <li>▪ The liver</li> <li><b><u>Homeostasis &amp; Response</u></b> <ul style="list-style-type: none"> <li>▪ The importance of homeostasis</li> <li>▪ The nervous system</li> <li>▪ Reflex actions</li> <li>▪ Endocrine system and negative feedback</li> <li>▪ Blood glucose</li> <li>▪ Reproductive hormones</li> </ul> </li> <li><b><u>Ecology</u></b> <ul style="list-style-type: none"> <li>▪ Classification</li> <li>▪ Ecology</li> <li>▪ Biotic and abiotic factors</li> <li>▪ Distribution of organisms</li> <li>▪ Required practical: distribution of organisms</li> <li>▪ Adaptations</li> <li>▪ Levels of organisation in a food chain</li> <li>▪ Predator/prey cycles</li> <li>▪ Carbon cycle and water cycle</li> <li>▪ Biodiversity</li> <li>▪ Population growth/water pollution</li> <li>▪ Air pollution</li> <li>▪ Land use</li> <li>▪ Deforestation</li> <li>▪ Maintaining biodiversity</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>▪ Genetic engineering</li> <li>▪ Variation</li> <li>▪ Selective breeding</li> <li>▪ Evolution – natural selection</li> <li>▪ Evolution of antibiotic resistant bacteria</li> <li>▪ Evidence for evolution – fossils</li> <li>▪ Extinction</li> </ul>
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<p><b>PHYSICS</b></p>	<ul style="list-style-type: none"> <li>▪ Calculate weight from quantities of mass and gravitational field strength</li> <li>▪ Construct force diagrams</li> <li>▪ Calculate resultant forces</li> <li>▪ Recall the equation for, and correct calculate, work done</li> <li>▪ Explain the theory behind the equation for Hooke's law (relationship between force and extension in a spring)</li> <li>▪ Calculate the moment about a pivot</li> <li>▪ Calculate pressure</li> <li>▪ Explain the difference between speed and acceleration using calculations and units</li> <li>▪ Describe thinking, braking and stopping distance- and factors that can affect these</li> <li>▪ Compare and contrast distance-time and velocity-time graphs of motion</li> <li>▪ Describe the different types of bodies in the solar system</li> <li>▪ Describe what comets are</li> <li>▪ Compare different types of satellites using examples</li> <li>▪ Explain the key events of the Big Bang Theory</li> <li>▪ Describe how stars are formed</li> <li>▪ Electricity &amp; Magnetism;</li> <li>▪ Recall circuit symbols for commonly used components</li> <li>▪ Compare and measure the quantities of current and potential difference</li> <li>▪ Describe and investigate resistance in a circuit</li> <li>▪ Explain static electricity with examples</li> <li>▪ Describe the components</li> </ul>	<ul style="list-style-type: none"> <li>▪ Recall the types of energy</li> <li>▪ Describe energy transfers in different devices such as; lights, TVs, washing machines and power stations</li> <li>▪ Calculate the efficiency of energy transfers</li> <li>▪ Compare and contrast heat and temperature</li> <li>▪ Describe how heat is transferred in the processes of; conduction, convection and radiation</li> <li>▪ Calculate and describe the power of different devices</li> <li>▪ Calculate the work done by different devices in terms of energy transferred</li> <li>▪ Use calculations of work done and energy transferred to evaluate how much devices cost to run</li> <li>▪ Recall and describe the generation of energy via renewable and Non-renewable resources, stating advantages and disadvantages for each method</li> <li>▪ Re-cap key circuit diagrams and symbols</li> <li>▪ Explain devices that are Ohmic and non-ohmic. Explain this in terms of current and potential difference</li> <li>▪ Explain how fuses and circuit breakers work in a circuit and how they contribute to overall safety of devices</li> <li>▪ Construct and explain motors</li> <li>▪ Explain solids, liquids and gases in terms of particle theory</li> <li>▪ Describe, calculate and investigate the density of different objects using principles such as displacement</li> <li>▪ Explain changes of state in terms of particles</li> <li>▪ Link calculation of pressure to the pressure in solids, liquids and gases</li> <li>▪ Describe the constituents of</li> </ul>	<p><b><u>Particle Model of Matter</u></b></p> <ul style="list-style-type: none"> <li>• Density</li> <li>• Required Practical – Density</li> <li>• States of matter and internal energy</li> <li>• Changes of State</li> <li>• Specific latent heat</li> <li>• Gas pressure and temperature</li> </ul> <p><b><u>Atomic Structure</u></b></p> <ul style="list-style-type: none"> <li>• Atoms and isotopes</li> <li>• Development of the model of the atom</li> <li>• Atoms and nuclear radiation</li> <li>• Nuclear equations</li> <li>• Half-life</li> <li>• Radioactive contamination</li> </ul> <p><b><u>Energy</u></b></p> <ul style="list-style-type: none"> <li>• Energy transfers</li> <li>• Efficiency</li> <li>• Kinetic energy</li> <li>• Gravitational potential energy</li> <li>• Required practical: Elastic potential energy</li> <li>• Required practical: specific heat capacity</li> <li>• Work done</li> <li>• Power</li> <li>• Non-renewable resources</li> <li>• Renewable resources</li> </ul>	<p><b><u>Electricity</u></b></p> <ul style="list-style-type: none"> <li>▪ Circuit symbols</li> <li>▪ Electric current, resistance and potential difference</li> <li>▪ Required practical: resistance</li> <li>▪ Series and parallel circuits</li> <li>▪ Required practical: current-potential difference graphs</li> <li>▪ Control circuits, light dependent resistors and thermistors</li> <li>▪ Alternating current and the plug</li> <li>▪ National grid</li> <li>▪ Power</li> <li>▪ Energy and power</li> </ul> <p><b><u>Waves</u></b></p> <ul style="list-style-type: none"> <li>▪ The nature and properties of waves</li> <li>▪ The electromagnetic spectrum</li> <li>▪ Infrared radiation</li> <li>▪ Communications and ultraviolet waves, x-rays and gamma rays</li> <li>▪ X-rays in medicine and electromagnetic waves</li> </ul> <p><b><u>Magnetism and Electromagnetism</u></b></p> <ul style="list-style-type: none"> <li>▪ Magnetism and magnetic forces</li> <li>▪ Compasses and magnetic fields</li> <li>▪ The magnetic effect of a solenoid</li> <li>▪ Fleming's left hand rule</li> <li>▪ Calculating the force on a conductor</li> <li>▪ Electric motors</li> <li>▪ The generator effect</li> <li>▪ Loudspeakers and microphones</li> <li>▪ Transformers</li> </ul>	<p><b><u>Forces</u></b></p> <ul style="list-style-type: none"> <li>▪ Forces and their interactions</li> <li>▪ Weight</li> <li>▪ Resultant forces</li> <li>▪ Free body diagrams</li> <li>▪ Free fall body diagrams</li> <li>▪ Vector diagrams</li> <li>▪ Work done and energy transfer</li> <li>▪ Forces and elasticity</li> <li>▪ Forces and motion</li> <li>▪ Distance, displacement, speed and velocity</li> <li>▪ Distance-time graphs</li> <li>▪ Speed-time graphs</li> <li>▪ Required practical: acceleration</li> <li>▪ Uniform motion</li> <li>▪ Terminal velocity</li> <li>▪ Newton's laws</li> <li>▪ Stopping and braking distances</li> <li>▪ Momentum</li> </ul>
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	<ul style="list-style-type: none"> <li>of a plug</li> <li>Describe a magnetic field around a bar magnet</li> <li>Explain and investigate electromagnets</li> <li>Light &amp; Sound;</li> <li>Explain how a spectrum of light is obtained</li> <li>Describe how filters work</li> <li>Explain the main parts of the human eye, and their function in vision</li> <li>Explain and investigate the process of reflection</li> <li>Explain and investigate the process of refraction</li> <li>Explain how sound waves are formed, and how they are different for different types of sounds</li> <li>Describe how echoes and ultrasound work with examples such as bats and submarines</li> </ul>	<ul style="list-style-type: none"> <li>atoms and isotopes</li> <li>Compare and contrast the types of radiation; alpha, beta and gamma</li> <li>Describe uses and dangers of radioactive sources</li> <li>Describe ways to maintain safety using radioactive sources</li> <li>Give examples of transverse and longitudinal waves</li> <li>Explain differences between transverse and longitudinal waves</li> <li>Recall the waves that make up the electromagnetic spectrum, in order</li> <li>Describe how waves can be used to detect objects</li> <li>Describe and investigate the three ways that waves can behave; reflection, refraction and diffraction</li> <li>Explain how light behaves when passed through different types of lenses</li> </ul>			
<b>CHEMISTRY</b>	<ul style="list-style-type: none"> <li>Explain what particles make up; such as atoms and molecules</li> <li>Describe states of matter in terms of particles and their arrangement</li> <li>Complete investigation of heating and cooling of substances. Describe their heating/cooling curve</li> <li>Describe the substances found in the periodic table</li> <li>Explain and construct diagrams of, the arrangement of compounds, giving examples</li> <li>Compare and contrast mixtures and compounds</li> <li>Complete investigation into how substances can be separated by; chromatography, filtration, magnet, fractional</li> </ul>	<ul style="list-style-type: none"> <li>Describe the atomic structure of atoms, elements and compounds</li> <li>Recall the mass number and atomic number of elements and isotopes</li> <li>Describe the electronic structure of elements</li> <li>Describe patterns in groups and periods of the periodic table</li> <li>Compare and contrast metals and non-metals in terms of their properties, structure and usage</li> <li>Complete word and symbol equations for common chemical reactions following standard chemical format</li> <li>Describe different types of burning fuels; resulting in complete and incomplete combustion</li> <li>Describe the principle of conservation of mass giving and example from chemical reactions</li> <li>Describe and investigate</li> </ul>	<p><b><u>Atomic Structure</u></b></p> <ul style="list-style-type: none"> <li>The atom</li> <li>Equations and formulae</li> <li>Separation techniques</li> <li>Distillation and chromatography</li> <li>Changing ideas about the atom</li> <li>Sub-atomic particles</li> <li>Mass and isotopes</li> <li>Electronic configuration</li> <li>Origins of the periodic table</li> <li>Organisation of the periodic table</li> <li>Group 1</li> <li>Group 7</li> <li>Group trends</li> </ul> <p><b><u>Bonding, Structure &amp; properties of matter</u></b></p> <ul style="list-style-type: none"> <li>States of matter</li> <li>Ionic bonding</li> <li>Giant ionic structures</li> <li>Covalent bonding</li> <li>Structure of simple covalent</li> </ul>	<p><b><u>Chemical changes</u></b></p> <ul style="list-style-type: none"> <li>Metal oxides</li> <li>Reactivity series</li> <li>Extraction of metals</li> <li>Metals and acids</li> <li>Required practical – neutralisation and producing of salts</li> <li>Soluble salts</li> <li>pH scale and neutralisation</li> <li>electrolysis of molten compounds</li> <li>electrolysis of aqueous solutions</li> <li>using electrolysis to extract metals</li> </ul> <p><b><u>Rate &amp; Extent of Chemical Change</u></b></p> <ul style="list-style-type: none"> <li>rate of reaction</li> <li>Collision theory and surface area</li> <li>The effect of temperature</li> <li>Required practical - the</li> </ul>	<p><b><u>Quantitative chemistry</u></b></p> <ul style="list-style-type: none"> <li>Calculating relative atomic mass and moles</li> <li>Calculating mass from an equation</li> <li>Use concentration to calculate the mass of a solute</li> </ul>

	distillation, simple distillation <ul style="list-style-type: none"> <li>Explain the types of substances the separation techniques can separate</li> <li>Describe the composition of the atmosphere, and how it can and has changed</li> <li>Give examples of greenhouse gases and describe the affect they have upon the Earth</li> <li>Link greenhouse gases to climate change</li> <li>Give examples of atmospheric pollutants and describe how they work</li> </ul>	exothermic and endothermic reactions <ul style="list-style-type: none"> <li>Describe reactions between metals and acids</li> <li>Describe reactions between metals and oxygen</li> <li>Describe reactions between metals and water</li> <li>Describe the process of displacement in chemical reactions, giving examples</li> <li>Describe how metals can be extracted from impure substances</li> <li>Give examples of acids and alkalis in everyday life</li> <li>Describe how indicators can be used and link this to the pH scale</li> <li>Recall some common indicators and their positive results for acids and alkalis</li> <li>Explain how a neutralisation reaction works, and link this to understanding of acids, alkalis and the pH scale</li> <li>Explain and investigate how salts can be made using acids alkalis</li> </ul>	molecules <ul style="list-style-type: none"> <li>Structure of giant covalent structures</li> <li>Graphene and fullerenes</li> <li>Bonding and properties of metals</li> </ul> <u>Energy Changes</u> <ul style="list-style-type: none"> <li>Exothermic and endothermic reactions</li> <li>Required practical – investigating temperature changes</li> <li>Energy level diagrams</li> </ul> <u>Chemical analysis</u> <ul style="list-style-type: none"> <li>Pure substances and formulations</li> <li>Chromatography required practical – calculating Rf values</li> <li>Testing for chlorine, oxygen, hydrogen and carbon dioxide</li> </ul> <ul style="list-style-type: none"> <li></li> </ul> <u>Chemistry of the atmosphere</u> <ul style="list-style-type: none"> <li>The Earth's atmosphere</li> <li>The greenhouse effect</li> <li>Carbon footprint and atmospheric pollutants</li> </ul>	effect of concentration <ul style="list-style-type: none"> <li>The effect of a catalyst</li> <li>Reversible reactions</li> <li>Energy changes in reversible reactions</li> </ul> <u>Using resources</u> <ul style="list-style-type: none"> <li>Using the Earth's resources and Potable Water</li> <li>Waste water treatment</li> <li>The life cycle and recycling</li> </ul> <u>Organic chemistry</u> <ul style="list-style-type: none"> <li>Hydrocarbons, alkanes and fractional distillation</li> <li>Combustion</li> <li>Cracking and alkenes</li> </ul>	
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## GCSE External assessment:

Combined science is assessed by six written examinations, each exam lasting 1 hour and 15 minutes. All examinations are taken at the end of Year 11. Two grades are awarded as described in the table.

	Weighting	
Biology paper 1	16.7%	The qualification will be graded on a 17-point scale: 1 – 1 to 9 – 9, where 9 – 9 is the best grade. This counts as two GCSE grades.
Biology paper 2	16.7%	
Chemistry paper 1	16.7%	
Chemistry paper 2	16.7%	
Physics paper 1	16.7%	
Physics paper 2	16.7%	

Each examination is available at two tiers. Teachers will use internal class assessments to decide which tier is most appropriate for each student.

Tier	Available Grades
Higher	4-4 to 9-9
Foundation	1-1 to 5-5

In addition to acquiring knowledge and understanding, students learn a range of practical and investigative skills that are assessed in each of the 6 examinations.

## **SMSC in science:**

### **Spiritual development in science**

In the science department we look to maintain a neutral approach as we study issues and ideas which are sometimes a source of tension in our society today. The modern world is full of potential areas for conflict, when scientific and spiritual ideas come together. Students will study topics such as evolution and the universe's origins using an evidence-based approach. This means scientific theories can be introduced then evaluated from an unbiased perspective. From this students often see how it is possible for spiritual and scientific theories to exist alongside each other, and how this may lead to more tolerance of different viewpoints.

### **Moral development in science**

Rapid advances in science have given us the opportunity to influence and change the world in which we live, often with positive outcomes. However, the new powers given to society by science have also led to moral issues arising, and in lots of cases vigorous debate surrounds these ideas, for example with genetically modified organisms. We give students the opportunity to engage with some of the most significant scientific developments and to weigh up the evidence to form their own conclusions on some moral issues facing society today. This is not only a key exam skill, but a vital skill for all students as they develop as young adults.

### **Social development in science**

The impact of science on society is extremely significant. Medical advances in particular are changing the way we live, with a continued increase in global population and longer life expectancy. Students will study the scientific advances that have led to this, the problems caused and possible solutions to them, whilst being encouraged to deepen their own understanding and form and support views using scientific fact. Through this approach students will gain a wider perspective on the changing society that surrounds them.

### **Cultural development in science**

Achievement in the field of science is truly global, and promoting cultural awareness is an intrinsic part of the science curriculum. From the Russian origins of the periodic table to the discovery of radioactivity by the French physicist Henri Becquerel, progress in all areas of scientific study is a consequence of a worldwide commitment to continuing discovery.