Curriculum overview: Science (Separate award)

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
BIOLOGY	▪ Describe the stricture of different types of cells ▪ Compare prokaryotic and eukaryotic cells ▪ Correctly set up and use a microscope ▪ Calculate magnification ▪ Explain the specialisation of some cells such as; nerve, root hair, gametes and	▪ Describe and explain specific and non-specific immune responses ▪ Describe different types of pathogens and the implications they can have on the working of the body and cells ▪ Explain how vaccination works ▪ Describe the function of antibiotics linked to pathogens	**<u>Cell biology</u>** • Required practical: Plant and animal cells • Eukaryotic and prokaryotic cells • Microscopy • Cell specialisation • Differentiation and stem cells • Culturing microorganisms	**<u>Bioenergetics</u>** • Photosynthesis • Limiting factors of photosynthesis • Required practical: light and photosynthesis • Adaptations and using glucose • Respiration • Anaerobic respiration	**<u>Inheritance, variation & Evolution</u>** • Sexual and asexual reproduction • Meiosis • DNA structure • Inheritance – test cross • Inheritance – other examples • Sex determination

	ciliated ▪ Compare and contrast the processes of diffusion an osmosis in biological examples ▪ Body systems; ▪ Describe the structure of cells and tissues in the body ▪ Explain the function of enzymes and the digestive system ▪ Label and explain the functions of the heart ▪ Describe gaseous exchange ▪ Describe how reflexes work using understanding of the nervous system ▪ Compare and contrast aerobic and anaerobic respiration ▪ Recall the main structure of plant tissues and organs ▪ Describe adaptations of leaves, and link this to external factors such as weather, pollination and predation ▪ Explain the process of photosynthesis ▪ Evaluate the factors that can affect the rate of photosynthesis; both natural and man-made	▪ Describe resistance to pathogens ▪ Recall the structures of the reproductive organs of males and females ▪ Describe the functions of sex cells in males and females, including the process of fertilisation ▪ Explain the stages of the menstrual cycle ▪ Describe variation of a species ▪ Explain how selective breeding works, and why it is done ▪ Recall the fundamentals of genetics and inheritance; such as punnet square diagrams, genotypes and phenotypes ▪ Describe how different organisms can compete, and what for ▪ Describe adaptations of organisms to suit their habitat and function ▪ Explain the theory of natural selection and evolution- link this to characteristics and extinction ▪ Explain feeding relationships of groups of organisms ▪ Explain how organisms can be sampled ▪ Recall the stages of the water cycle ▪ Explain how water and land can be biologically polluted ▪ Describe deforestation; reasons and consequences ▪ Link aspects of biological progresses to global warming	• Mitosis • Diffusion • Required practical: osmosis • Active transport • Exchanging materials **Organisation** • Principles of organisation • Digestive system • Required practical: chemistry of food • Enzymes • Required practical: enzymes • Efficiency of digestion • Heart and circulation • Blood • Blood vessels • Coronary heart disease • Smoking, alcohol and diet • Lifestyle • Cancer • Lungs and gas exchange • Plans tissues and organs • Transpiration **Infection & Response** • Communicable diseases • Protist diseases – malaria • First line of defence • Second line of defence • Vaccination • MRSA • Antibiotics and painkillers • Discovery and development of drugs • Development and use of monoclonal antibodies • Detection and identification of plant disease • Plant defence response	• Exercise • The liver **Homeostasis & Response** • The importance of homeostasis • The nervous system • Reflex actions • The brain • The eye • Thermoregulation • Endocrine system and negative feedback • Blood glucose • Osmoregulation • Reproductive hormones • Plant hormones **Ecology** ▪ Classification ▪ Ecology ▪ Biotic and abiotic factors ▪ Distribution of organisms ▪ Required practical: distribution of organisms ▪ Adaptations ▪ Levels of organisation in a food chain ▪ Decomposition ▪ Impact of environmental change ▪ Predator/prey cycles ▪ Carbon cycle and water cycle ▪ Biodiversity ▪ Population growth/water pollution ▪ Air pollution ▪ Land use ▪ Deforestation ▪ Maintaining biodiversity ▪ Trophic levels in an ecosystem ▪ Food production	• Genetic engineering • Cloning • Variation • Selective breeding • Evolution – natural selection • Evolution of antibiotic resistant bacteria • Evidence for evolution – fossils • Extinction

PHYSICS	▪ Calculate weight from quantities of mass and gravitational field strength ▪ Construct force diagrams ▪ Calculate resultant forces ▪ Recall the equation for, and correct calculate, work done ▪ Explain the theory behind the equation for Hooke's law (relationship between force and extension in a spring) ▪ Calculate the moment about a pivot ▪ Calculate pressure ▪ Explain the difference between speed and acceleration using calculations and units ▪ Describe thinking, braking and stopping distance- and factors that can affect these ▪ Compare and contrast distance-time and velocity-time graphs of motion ▪ Describe the different types of bodies in the solar system ▪ Describe what comets are ▪ Compare different types of satellites using examples ▪ Explain the key events of the Big Bang Theory ▪ Describe how stars are formed ▪ Electricity & Magnetism; ▪ Recall circuit symbols for commonly used components ▪ Compare and measure the quantities of current and potential difference ▪ Describe and investigate resistance in a circuit ▪ Explain static electricity with examples ▪ Describe the components of a plug ▪ Describe a magnetic field around a bar magnet ▪ Explain and investigate electromagnets ▪ Light & Sound;	▪ Recall the types of energy ▪ Describe energy transfers in different devices such as; lights, TVs, washing machines and power stations ▪ Calculate the efficiency of energy transfers ▪ Compare and contrast heat and temperature ▪ Describe how heat is transferred in the processes of; conduction, convection ad radiation ▪ Calculate and describe the power of different devices ▪ Calculate the work done buy different devices in terms of energy transferred ▪ Use calculations of work done and energy transferred to evaluate how much devices cost to run ▪ Recall and describe the generation of energy via renewable and Non-renewable resources, stating advantages and disadvantages for each method ▪ Re-cap key circuit diagrams and symbols ▪ Explain devices that are Ohmic and non-ohmic. Explain this in terms of current and potential difference ▪ Explain how fuses and circuit breakers work in a circuit and how they contribute to overall safety of devices ▪ Construct and explain motors ▪ Explain solids, liquids and gases in terms of particle theory ▪ Describe, calculate and investigate the density of different objects using principles such as displacement ▪ Explain changes of state in terms of particles ▪ Link calculation of pressure to the pressure in solids, liquids and gases	**Particle Model of Matter** ▪ Density ▪ Required Practical – Density ▪ States of matter and internal energy ▪ Changes of State ▪ Specific latent heat ▪ Gas pressure and temperature ▪ Increasing the pressure of a gas **Atomic Structure** ▪ Atoms and isotopes ▪ Development of the model of the atom ▪ Atoms and nuclear radiation ▪ Nuclear equations ▪ Half-life ▪ Radioactive contamination ▪ Hazards and uses of radioactive emissions ▪ Nuclear fission and fusion **Energy** ▪ Energy transfers ▪ Efficiency ▪ Kinetic energy ▪ Gravitational potential energy ▪ Required practical: Elastic potential energy ▪ Required practical: specific heat capacity ▪ Work done ▪ Power ▪ Non-renewable resources ▪ Renewable resources	**Electricity** ▪ Circuit symbols ▪ Electric current, resistance and potential difference ▪ Required practical: resistance ▪ Series and parallel circuits ▪ Required practical: current-potential difference graphs ▪ Control circuits, light dependent resistors and thermistors ▪ Alternating current and the plug ▪ National grid ▪ Static electricity ▪ Power ▪ Energy and power **Waves** ▪ The nature and properties of waves ▪ Reflection of waves ▪ Sound waves ▪ Reflection and refraction ▪ The electromagnetic spectrum ▪ Infrared radiation ▪ Communications and ultraviolet waves, x-rays and gamma rays ▪ X-rays in medicine and electromagnetic waves ▪ Lenses ▪ Visible light ▪ Black body radiation **Magnetism and Electromagnetism** ▪ Magnetism and magnetic forces ▪ Compasses and magnetic fields ▪ The magnetic effect of a solenoid ▪ Flemings left hand rule ▪ Calculating the force on a conductor ▪ Electric motors ▪ Loudspeakers ▪ The generator effect ▪ Loudspeakers and	**Forces** ▪ Forces and their interactions ▪ Weight ▪ Resultant forces ▪ Free body diagrams ▪ Free fall body diagrams ▪ Vector diagrams ▪ Work done and energy transfer ▪ Forces and elasticity ▪ Moments, levers, and gears ▪ Pressure, and pressure differences in fluids ▪ Forces and motion ▪ Distance, displacement, speed and velocity ▪ Distance-time graphs ▪ Speed-time graphs ▪ Required practical: acceleration ▪ Uniform motion ▪ Terminal velocity ▪ Newton's laws ▪ Stopping and braking distances ▪ Momentum ▪ Changes in momentum **Space physics** ▪ Our solar system ▪ Life cycle of a star ▪ Orbital motion and natural and artificial satellites ▪ Red shift

	▪ Explain how a spectrum of light is obtained ▪ Describe how filters work ▪ Explain the main parts of the human eye, and their function in vision ▪ Explain and investigate the process of reflection ▪ Explain and investigate the process of refraction ▪ Explain how sound waves are formed, and how they are different for different types of sounds ▪ Describe how echoes and ultrasound work with examples such as bats and submarines ▪	▪ Describe the constituents of atoms and isotopes ▪ Compare and contrast the types of radiation; alpha, beta and gamma ▪ Describe uses and dangers of radioactive sources ▪ Describe ways to maintain safety using radioactive sources ▪ Give examples of transverse and longitudinal waves ▪ Explain differences between transverse and longitudinal waves ▪ Recall the waves that make up the electromagnetic spectrum, in order ▪ Describe how waves can be used to detect objects ▪ Describe and investigate the three ways that waves can behave; reflection, refraction and diffraction ▪ Explain how light behaves when passed through different types of lenses		microphones ▪ Transformers ▪ Induced potential and the national grid	
CHEMISTRY	▪ Explain what particles make up; such as atoms and molecules ▪ Describe states of matter in terms of particles and their arrangement ▪ Complete investigation of heating and cooling of substances. Describe their heating/cooling curve ▪ Describe the substances found in the periodic table ▪ Explain and construct diagrams of, the arrangement of compounds, giving examples ▪ Compare and contrast mixtures and compounds ▪ Complete investigation into how substances can be separated by; chromatography, filtration, magnet, fractional distillation, simple distillation	▪ Describe the atomic structure of atoms, elements and compounds ▪ Recall the mass number and atomic number of elements and isotopes ▪ Describe the electronic structure of elements ▪ Describe patterns in groups and periods of the periodic table ▪ Compare and contrast metals and non-metals in terms of their properties, structure and usage ▪ Complete word and symbol equations for common chemical reactions following standard chemical format ▪ Describe different types of burning fuels; resulting in complete and incomplete combustion ▪ Describe the principle of conservation of mass giving and example from chemical	**<u>Atomic Structure</u>** ▪ The atom ▪ Equations and formulae ▪ Separation techniques ▪ Distillation and chromatography ▪ Changing ideas about the atom ▪ Sub-atomic particles ▪ Mass and isotopes ▪ Electronic configuration ▪ Origins of the periodic table ▪ Organisation of the periodic table ▪ Group 1 ▪ Group 7 ▪ Group trends ▪ The transition elements **<u>Bonding, Structure & properties of matter</u>** ▪ States of matter ▪ Ionic bonding ▪ Giant ionic structures ▪ Covalent bonding	**<u>Chemical changes</u>** ▪ Metal oxides ▪ Reactivity series ▪ Extraction of metals ▪ Oxidation and reduction ▪ Metals and acids ▪ Required practical – neutralisation and producing of salts ▪ Soluble salts ▪ pH scale and neutralisation ▪ strong and weak acids ▪ Titration ▪ electrolysis of molten compounds ▪ electrolysis of aqueous solutions ▪ using electrolysis to extract metals ▪ half equations at the electrodes. ▪ **<u>Rate & Extent of Chemical Change</u>** ▪ rate of reaction	**<u>Quantitative chemistry</u>** ▪ Calculating relative atomic mass and moles ▪ Avogadro's constant ▪ Calculating mass and moles from an equation ▪ Balance equations to calculate mass ▪ Yield and atom economy ▪ Use concentration to calculate the mass of a solute ▪ Concentrations in mol/dm^3 ▪ The amount of substance in relation to volume of gases

	▪ Explain the types of substances the separation techniques can separate ▪ Describe the composition of the atmosphere, and how it can and has changed ▪ Give examples of greenhouse gases and describe the affect they have upon the Earth ▪ Link greenhouse gases to climate change ▪ Give examples of atmospheric pollutants and describe how they work	reactions ▪ Describe and investigate exothermic and endothermic reactions ▪ Describe reactions between metals and acids ▪ Describe reactions between metals and oxygen ▪ Describe reactions between metals and water ▪ Describe the process of displacement in chemical reactions, giving examples ▪ Describe how metals can be extracted from impure substances ▪ Give examples of acids and alkalis in everyday life ▪ Describe how indicators can be used and link this to the pH scale ▪ Recall some common indicators and their positive results for acids and alkalis ▪ Explain how a neutralisation reaction works, and link this to understanding of acids, alkalis and the pH scale ▪ Explain and investigate how salts can be made using acids alkalis	▪ Structure of simple covalent molecules ▪ Structure of giant covalent structures ▪ Graphene and fullerenes ▪ Bonding and properties of metals ▪ Properties and uses of nanotechnology **Energy Changes** ▪ Exothermic and endothermic reactions ▪ Required practical – investigating temperature changes ▪ Energy level diagrams ▪ Electrical cells ▪ Hydrogen fuel cells **Chemical analysis** ▪ Pure substances and formulations ▪ Chromatography required practical – calculating Rf values ▪ Testing for chlorine, oxygen, hydrogen and carbon dioxide ▪ Spectroscopic testing ▪ Identification of ions as hydroxides, halides and sulfate. **Chemistry of the atmosphere** ▪ The Earth's atmosphere ▪ The greenhouse effect ▪ Carbon footprint and atmospheric pollutants	▪ Collison theory and surface area ▪ The effect of temperature ▪ Required practical - the effect of concentration ▪ The effect of a catalyst ▪ Reversible reactions ▪ Energy changes in reversible reactions ▪ Dynamic equilibrium ▪ Altering conditions at equilibrium **Using resources** ▪ Using the Earth's resources and Potable Water ▪ Waste water treatment ▪ Bioleaching and phytomining ▪ The life cycle and recycling ▪ Corrosion and its prevention ▪ Uses of ceramics, polymers and composites ▪ The Haber process **Organic chemistry** ▪ Hydrocarbons, alkanes and fractional distillation ▪ Combustion ▪ Cracking and alkenes ▪ Reactions of alkenes and alcohols ▪ Carboxylic acids ▪ Polymerisation ▪ Biological polymers	

GCSE External assessment:

Students studying the separate sciences will achieve three science GCSEs at the end of Year 11. These will be in the following subjects

- GCSE biology
- GCSE chemistry
- GCSE physics

All content is examined at the end of Year 11. All of the GCSE science courses are split into two units:

	Weighting	
Biology Paper 1	50%	A GCSE grade in Biology from grade 9 to grade 1

Biology Paper 2	50%	
Chemistry Paper 1	50%	A GCSE grade in Chemistry from grade 9 to grade 1
Chemistry Paper 2	50%	
Physics Paper 1	50%	A GCSE grade in Physics from grade 9 to grade 1
Physics Paper 2	50%	

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

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

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.