**Southmoor Academy**

**Science Curriculum**

**Aspire Achieve Enjoy**

**Aim**

Here at Southmoor Academy, we aim to securely equip **all** of our students for life beyond school as successful, confident, responsible and respectful citizens. We believe that education provides the key to **social mobility** and our curriculum is designed to build strong foundations in the knowledge, understanding and skills which lead to **academic and personal success**. We want our students to **enjoy** the challenges that learning offers.

Our aims are underpinned by a culture of **high aspirations**. Through developing positive relationships, we work towards every individual having a strong belief in their own abilities so that they work hard, build resilience and **achieve** their very best.

**Intent**

We aim to provide a high-quality science education that provides the foundations for understanding the world through the disciplines of biology, chemistry and physics. Science is changing our lives and is vital to the world’s future prosperity, and all students should be taught essential aspects of foundational knowledge, methods, processes and uses of science. Through building up a body of core knowledge and concepts, pupils are encouraged to recognise the power of rational explanation and develop a sense of excitement and curiosity about natural phenomena. They will be encouraged to understand how science can be used to explain what is occurring, predict how things will behave, and analyse causes.

The curriculum aims to ensure that knowledge is taught to be remembered, not encountered. The curriculum embraces learning from cognitive science about memory, forgetting and the power of retrieval practice. Knowledge for each unit is planned vertically and horizontally, giving thought to the optimum knowledge sequence for building secure schema.

The curriculum aims for pupils to:

* Develop scientific knowledge through the disciplines of biology, chemistry and physics;
* Develop understanding of the nature, processes and methods of science through different types of scientific enquiry that help them answer scientific questions about the world around them;
* Develop and learn to apply observational, practical, modelling, enquiry, problem solving and mathematical skills, both in the laboratory, in the field and other environments;
* Develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively.

Throughout our programmes of study, every attempt is made to make explicit links to careers and the world of work. In addition to subject specific links, we aim to explicitly reinforce the skills and aptitudes which support employers say are important in the workplace;

* Resilience (Aiming High Staying Positive Learning from Mistakes)
* Collaboration (Teamwork Leadership Communication)
* Creativity (Originality, Problem Solving, Independent Study)

The British values of democracy, the rule of law, individual liberty, and mutual respect of those with different faiths and beliefs are taught explicitly and reinforced in the way in which the school operates.

**Sequence and structure**

Our curriculum is split into Key Stage 3 (years 7 and 8) and Key Stage 4 (years 9, 10 and 11). Our longer school day and generous allocation of curriculum time ensures a strong foundation of knowledge and skills for success at KS4.

**The Key Stage 3 Science Curriculum includes the following areas of study:**

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| --- | --- | --- | --- | --- | --- | --- |
| KS3 | Half Term 1 | Half Term 2 | Half Term 3 | Half Term 4 | Half Term 5 | Half Term 6 |
| Year 7 | **Cells and Organisation**  Comparing, contrasting, analysing cell structure. Organisation of cells into tissues, organs and systems. Transport of substances in and out of cells. Pupils will develop microscopy skills.  **Atoms, elements, compounds**  Describing a simple (Dalton) atomic model  Comparing atoms, elements and compounds.  Pure and impure substances. The concept of a pure substance mixtures, including dissolving, diffusion in terms of the particle model. Simple techniques for separating mixtures: filtration, evaporation, distillation and chromatography  **Energy**  Processes that involve energy transfer: changing motion, dropping an object, completing an electrical circuit, stretching a spring, metabolism of food, burning fuels.  Investigating different forms of energy transfer such as conduction, convection, insulation. Using knowledge to apply energy saving measures to the home. | **Living systems in mammals**  Structure and function of living systems to include the respiratory, muscular, digestive and skeletal systems in mammals. Pupils will investigate food groups through practical opportunities.  **Particles and their behaviour**  Arrangement of particles in the three states of matter and their behaviour during changes of state, including properties of different states.  **Electricity**  Basic models to explain circuits. Investigating the mathematical relationship between current, potential difference and resistance. Separation of positive or negative charges when objects are rubbed together: transfer of electrons, forces between charged objects | **Living systems in mammals and plants**  Adaptations of plants and mammals to prevent the spread of disease. Plants making carbohydrates in their leaves by photosynthesis. Aerobic and anaerobic respiration in living organisms.  **Chemical reactions**  The pH scale for measuring acidity/alkalinity; and indicators.  **Chemical change**  Representing substances through formulae and chemical changes through balanced equations.  **Matter**  Conservation of material and of mass, and reversibility, in melting, freezing, evaporation, sublimation, condensation, dissolving, similarities and differences, including density differences, between solids, liquids and gases | **Reproduction in mammals**  Structure and function of reproductive systems, menstrual cycle, gametes, fertilisation, gestation and birth. Structure and function of the nervous system. Pupils will investigate this through testing reactions.  **Chemical reactions**  Reactions of acids with metals to produce a salt plus hydrogen. Reactions of acids with alkalis to produce a salt plus water**.** Investigating reactions between acids and metals, including applications such as batteries  **Chemical change**  Representing substances through formulae and chemical changes through balanced equations.  **Forces**  Describing forces as pushes and pulls. Measuring forces and representing forces using free body diagrams. | **Genetics and Evolution**  Differences between species. Variation between individuals within a species being continuous or discontinuous, to include measurement and graphical representation of variation.  **Earth and atmosphere**  Composition and structure of the Earth. Rock cycle and the formation of igneous, sedimentary and metamorphic rocks.  **Materials**  properties of ceramics, polymers and composites  **Waves**  The nature and properties of sound waves. Investigating sound waves.  Similarities and differences between light waves and waves in matter. Transmission of light through materials: absorption, diffuse scattering and specular reflection at a surface | **Relationships in ecosystems**  Interdependence, including food chains, webs and competition. The importance of plant reproduction in human food security.  **Earth and atmosphere**  Earth as a source of limited resources and the efficacy of recycling. Carbon cycle and the composition of the atmosphere  the production of carbon dioxide by human activity and the impact on climate.  **Magnetism** Magnetic poles, attraction and repulsion. Magnetic fields by plotting with compass, representation by field lines  **Space Physics**  Our Sun as a star, other stars in our galaxy, other galaxies. The seasons and the Earth’s tilt, day length at different times of year, in different hemispheres |
| Year 8 | **Cells and Organisation**  A more indepth study of cytology, including basic understanding of cell growth. Comparison of plants and animal cells with bacteria.  **Periodic Table**  History of how table was formed. Analysing structure, properties and uses of each group.  **Energy**  Investigating energy transfers and making calculations using relevant mathematical equations.  **Forces**  force-extension linear relation; Hooke’s Law as a special case work done andenergy changes on deformation. | **Nutrition and digestion**  Content of a healthy human diet: Calculations of energy requirements in a healthy daily diet. Consequences of imbalances in the diet, including obesity, starvation and deficiency diseases.  **Skeletal and muscular systems**  the structure and functions of the human skeleton, to include support, protection, movement and making blood cells  **Pure and impure substances**  Chemical properties of mixtures and the physical methods of separation. The identification of pure substances.  **Electricity**  Investigating the mathematical relationship between current, potential difference and resistance. Developing working scientifically skills by planning and conducting an investigation into resistance of electrical components. The structure of the national grid. | **Photosynthesis** Reactants in, and products of, photosynthesis. plants and algae. Plants use sunlight in photosynthesis to build organic molecules.  **Cellular respiration**  Process of anaerobic respiration in humans and micro-organisms, including fermentation. Differences between aerobic and anaerobic respiration in terms of the reactants, the products formed and the implications for the organism  **Materials**  Order of metals and carbon in the reactivity series. The use of carbon in obtaining metals from metal oxides  Role of electrolysis in metal extraction.  **Chemical reactions**  Investigating combustion and thermal decomposition, to include the concepts of endothermic and exothermic reactions.  **Energy**  Introduction to nuclear radiation as a non-renewable energy resource in terms of background radiation sources and how we can use it. | **Systems in mammals**  Structure and function of organs in the nervous system.  **Health**  Effects of recreational drugs (including substance misuse) on behaviour, health and life processes in pregnancy.  **Chemical reactions**  Investigating factors that can influence the speed of a reaction.  Chemical reactions as the rearrangement of atoms. Representing chemical reactions using formulae and using equations.  What catalysts do.  **Forces**  Moment as the turning effect of a force. Forces associated with deforming objects; stretching and squashing – springs; with rubbing and friction between surfaces, with pushing things out of the way;  Atmospheric pressure, decreases with increase of height as weight of air above decreases with height. pressure in liquids, increasing with depth; upthrust effects, floating and sinking. pressure measured by ratio of force over area – acting normal to any surface.  **Motion**  Describing motion through speed, distance and time. Representing motion through distance-time graphs. Pupils apply the concept of momentum to safety devices in vehicles. | **Genetics and evolution**  Heredity as the process by which genetic information is transmitted from one generation to the next.Simple model of chromosomes, genes and DNA in heredity, including the part played by Watson, Crick, Wilkins and Franklin in the development of the DNA model. Maintaining biodiversity and the use of gene banks to preserve hereditary material.  **Chemical reactions**  Identification of unknown substances, through using various chemical tests including gas tests and identification metals from precipitation.  **Waves**  Use of ray model to explain imaging in mirrors, the pinhole camera, the refraction of light and action of convex lens in focusing the human eye. Light transferring energy from source to absorber leading to chemical and electrical effects; photo-sensitive material in the retina and in cameras. Colours and the different frequencies of light, white light and prisms  Sound produced by vibrations of objects, in loud speakers, detected by their effects on microphone diaphragm and the ear drum; | **Relationships in an ecosystem I**nterdependence of organisms in an ecosystem, including food webs and insect pollinated crops. Importance of plant reproduction through insect pollination in human food security. How organisms affect, and are affected by, their environment, including the accumulation of toxic materials.  **Earth and atmosphere**  Composition of the atmosphere. The production of carbon dioxide by human activity and the impact on climate.  **Using materials**  Applications of ceramics, polymers and composites.  **Magnetism**  Earth’s magnetism, compass and navigation. Magnetic effect of a current, electromagnets, D.C. motors  **Space physics**  gravity force, weight = mass x gravitational field strength (g), on Earth g=10 N/kg, different on other planets and stars; gravity forces between Earth and Moon, and between Earth and Sun. |

We know that students who read well achieve well. As such all subject areas are committed to providing regular opportunities to read extensively and enrich learning.

**Key Stage 4 Science Curriculum**

At Key Stage 4 students follow the AQA Exam board, taking either Separate Science or Combined Science: Trilogy.

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| KS 4 | Half Term 1 | Half Term 2 | Half Term 3 | Half Term 4 | Half Term 5 | Half Term 6 |
| Year 9 | **Cell Biology**  Prokaryotic and eukaryotic cells as the basic structural units of all organisms. Comparing plant, animal and bacterial cells, including plant and animal stem cells. Investigating sub cellular structures using light and electron microscopy. Mitosis, stem cells and transport in cells.  **Atomic structure and the periodic table**  Development of the various atomic models from Dalton’s model to current nuclear model and the development of the periodic table. How atoms arrange themselves into elements, compounds and mixtures. Physical methods of separating mixtures.  Electron configuration, groups of the periodic table and bonding.  **Energy**  Energy stores, transfers and efficiency. Investigating specific heat capacity of materials. | **Cell reproduction and transport**  Gas exchange and circulatory systems necessary for larger organisms such as animals. Structure and function are explored in depth.  **Groups of the periodic table**  Properties and trends of the groups related to atomic structure. To gain greater stability, atoms can form ionic and covalent bonds. These structures have specific properties relating to their structure.  **Electricity**  Investigating I-V relationships of different components, including graphical representations. Compare and contrast series and parallel circuits. Compare and contrast AC and DC current. | **Health and Lifestyle**  Problems with organ systems such as heart disease and cancer. Transport systems in plants are investigated and compared to mammalian systems.  **Allotropes of Carbon**  Structure and properties of diamond, graphite and graphene. Nanoscience and nanoparticles are also explored.  Changes during chemical reactions can be measured using experimental techniques and a knowledge of moles. Masses can be calculated and used to balance equations.  **National grid**  How energy is supplied from power stations to homes and businesses.  Static electricity  Investigating static electricity and understanding the dangers. | **Disease**  Relationship between health and disease, with particular focus on communicable diseases. Role of the immune system against disease and the development of medicines.  **Energy changes in reactions**  Representing energy changes graphically and calculating energy changes through bond energy calculations.  Chemical and fuel cells as energy sources.  **Particle model of matter**  Behaviour of particles in substances. The concepts of density and particle behaviour during changes of state. Internal energy latent heat and specific heat capacity are explored further. | **Treating Disease**  Development of drugs, investigating effectiveness of disinfectants. Detecting and treating disease in plants.  **Reactions of metals**  Oxidation, neutralisation, investigating metals and hydroxides, preparing soluble salts from acids.  **Gas Laws**  Investigating the effect of temperature, pressure and volume on gases. | **Autotrophs**  Photosynthesis as a key process in food production and factors affecting rate of photosynthesis. Respiration  The importance of aerobic and anaerobic respiration in cells. Changes in respiration due to exercise and the physiological changes that follow.  **Titrations**  Find concentrations of unknown substances.  Investigating electrolysis.  **Radiation**  Recap atomic structure and theories of the atom, develop further to explain the unstable nature of large nuclei and how random decay produces predictable outcomes in terms of half life. Nuclear decay can be represented by equations. Understand that radioactive materials must be handled following very strict guidelines and correct clothing must be worn. |
| Year 10 | **Investigating factors which affect the rates of a chemical reaction.** Reversible reactions and equilibria.  Uses of radiation  Comparing nuclear fission and fusion as energy resources. Details on reactions, control and future viability are explored  **Coordination and control in humans**  Conscious and unconscious response pathways to environmental stimuli.  Coordination and control in humans  Conscious and unconscious response pathways to environmental stimuli.  Coordination and control in humans  Adrenaline and thyroxine in controlling metabolism. Investigating plant growth responses.  **Exploring contact and non-contact forces using free** body diagrams. Elastic energy changes investigated using springs and Hooke’s Law. | **Sexual and asexual reproduction**, the role of mitosis and meiosis. Determination of sex, gene expression and the inheritance of genetic disorders. Applications and implications of genetic engineering.  **Hydrocarbons**  Refining crude oil through fractional distillation and cracking. Properties and uses of hydrocarbons.  Fuels  Uses and properties of carboxylic acids. Polymerisation of compounds with reference to biological molecules. Chemical analysis of substances to find oxygen, carbon dioxide, metal ions, halides and sulphate ions.  **Quantitative Chemistry**  Moments in levers and gear systems.  Motion  Forces on submerged objects are explored. Mathematical relationships are used to investigate speed, distance and time. | **Future applications of genetics**  Cloning in humans and ethics of genetic profiling.  Evolution  Artificial and natural selection. Darwin’s theory of evolution and evidence for evolution. Factors causing extinction are also explored.  Classifying organisms  **Early atmosphere**  Causes of change in atmospheric composition. Human impact on atmosphere and how it may change  **Supplying water**  Purification, treatment and supply of water to populations.  Black body radiation  Investigating radiation by different materials.  **The applications of Newton’s laws** are explored. Laws of motion applied ion context of road safety (ie: stopping distances and impact force calculations to design road safety features). | **Investigating populations** through random sampling and effect of abiotic factors using transects. Energy flow though ecosystems including decay and carbon/water cycles.  **Materials**  Life cycle assessments and production of glass, ceramics, alloys and fertilisers.  .  **Waves**  Properties and uses of waves. Investigating sound and electromagnetic waves. Investigating light using concave and convex lenses. | **Exploration of human impact** upon environment. Role of biotechnology in maintaining biodiversity and food security.  **Quantitative Chemistry**  **Magnetism**  Investigating magnetic fields. Practical applications of the motor and generator effect | Biology required practical elements  Chemistry required practical elements  Physics required practical elements |
| Year 11 | **Cell Biology**  Prokaryotic and eukaryotic cells as the basic structural units of all organisms. Comparing plant, animal and bacterial cells, including plant and animal stem cells. Investigating sub cellular structures using light and electron microscopy. Mitosis, stem cells and transport in cells.  **Atomic structure and the periodic table**  Development of the various atomic models from Dalton’s model to current nuclear model and the development of the periodic table. How atoms arrange themselves into elements, compounds and mixtures. Physical methods of separating mixtures.  Electron configuration, groups of the periodic table and bonding.  **Energy**  Energy stores, transfers and efficiency. Investigating specific heat capacity of materials. | **Cell reproduction and transport**  Gas exchange and circulatory systems necessary for larger organisms such as animals. Structure and function are explored in depth.  **Groups of the periodic table**  Properties and trends of the groups related to atomic structure. To gain greater stability, atoms can form ionic and covalent bonds. These structures have specific properties relating to their structure.  **Electricity**  Investigating I-V relationships of different components, including graphical representations. Compare and contrast series and parallel circuits. Compare and contrast AC and DC current. | **Health and Lifestyle**  Problems with organ systems such as heart disease and cancer. Transport systems in plants are investigated and compared to mammalian systems.  **Allotropes of Carbon**  Structure and properties of diamond, graphite and graphene. Nanoscience and nanoparticles are also explored.  Changes during chemical reactions can be measured using experimental techniques and a knowledge of moles. Masses can be calculated and used to balance equations.  **National grid**  How energy is supplied from power stations to homes and businesses.  Static electricity  Investigating static electricity and understanding the dangers. | **Disease**  Relationship between health and disease, with particular focus on communicable diseases. Role of the immune system against disease and the development of medicines.  **Energy changes in reactions**  Representing energy changes graphically and calculating energy changes through bond energy calculations.  Chemical and fuel cells as energy sources.  **Particle model of matter**  Behaviour of particles in substances. The concepts of density and particle behaviour during changes of state. Internal energy latent heat and specific heat capacity are explored further. | **Exams** |  |
|  | **Investigating factors which affect the rates of a chemical reaction.** Reversible reactions and equilibria.  Uses of radiation  Comparing nuclear fission and fusion as energy resources. Details on reactions, control and future viability are explored  **Coordination and control in humans**  Conscious and unconscious response pathways to environmental stimuli.  Coordination and control in humans  Conscious and unconscious response pathways to environmental stimuli.  Coordination and control in humans  Adrenaline and thyroxine in controlling metabolism. Investigating plant growth responses.  **Exploring contact and non-contact forces using free** body diagrams. Elastic energy changes investigated using springs and Hooke’s Law. | **Sexual and asexual reproduction**, the role of mitosis and meiosis. Determination of sex, gene expression and the inheritance of genetic disorders. Applications and implications of genetic engineering.  **Hydrocarbons**  Refining crude oil through fractional distillation and cracking. Properties and uses of hydrocarbons.  Fuels  Uses and properties of carboxylic acids. Polymerisation of compounds with reference to biological molecules. Chemical analysis of substances to find oxygen, carbon dioxide, metal ions, halides and sulphate ions.  **Quantitative Chemistry**  Moments in levers and gear systems.  Motion  Forces on submerged objects are explored. Mathematical relationships are used to investigate speed, distance and time. The applications of Newton’s laws are explored. Laws of motion applied ion context of road safety | **Future applications of genetics**  Cloning in humans and ethics of genetic profiling.  Evolution  Artificial and natural selection. Darwin’s theory of evolution and evidence for evolution. Factors causing extinction are also explored.  Classifying organisms  **Early atmosphere**  Causes of change in atmospheric composition. Human impact on atmosphere and how it may change  **Supplying water**  Purification, treatment and supply of water to populations.  Black body radiation  Investigating radiation by different materials.  **The applications of Newton’s laws** are explored. Laws of motion applied ion context of road safety (ie: stopping distances and impact force calculations to design road safety features). | **Investigating populations** through random sampling and effect of abiotic factors using transects. Energy flow though ecosystems including decay and carbon/water cycles.  **Materials**  Life cycle assessments and production of glass, ceramics, alloys and fertilisers.  .  **Waves**  Properties and uses of waves. Investigating sound and electromagnetic waves. Investigating light using concave and convex lenses.  **Magnetism** |  |  |

For more information about the specific details of our curriculum, please refer to the subject specific pages of our website.

**How does our curriculum cater for students with SEND?**

Sandhill View is an inclusive academy where every child is valued and respected. We are committed to the inclusion, progress and independence of all our students, including those with SEN. We work to support our students to make progress in their learning, their emotional and social development and their independence. We actively work to support the learning and needs of all members of our community.

A child or young person has SEN if they have a learning difficulty or disability which calls for special educational provision to be made that is additional to or different from that made generally for other children or young people of the same age. (CoP 2015, p16)

Teachers are responsible for the progress of ALL students in their class and high-quality teaching is carefully planned; this is the first step in supporting students who may have SEND. All students are challenged to do their very best and all students at the Academy are expected to make at least good progress.

Specific approaches which are used within the curriculum areas include:

* Seating plans to allow inclusion
* Use of differentiation in lessons including challenge and support, differentiated tasks and differentiated reading materials.
* Where possible, use of additional support from adults is planned and communicated in advance.
* Intervention strategies are used when required.
* Written and verbal feedback to stretch and support pupil progress.
* Ensure all resources are accessible to all pupils
* Homework tasks to promote literacy and independent study.
* Use of data to support planning
* Group work
* Questioning and class discussion

**How does our curriculum cater for disadvantaged students and those from minority groups?**

As a school serving an area with high levels of deprivation, we work tirelessly to raise the attainment for all students and to close any gaps that exist due to social contexts. The deliberate allocation of funding and resources has ensured that attainment gaps are closing in our drive to ensure that all pupils are equally successful when they leave the Academy. More specifically within the teaching of Science, we:

* Provide targeted support for underperforming pupils;
* Use data to identify gaps and underperforming pupils;
* Discuss strategies and implement these in order to address pupils needs;
* Provide knowledge organisers for all pupils to support with essential, core, substantive knowledge;
* Ensure homework is accessible and where needed resources and support are provided outside of lesson time;
* Provide revision materials to pupils to reduce financial burdens on families.

**How do we make sure that our curriculum is implemented effectively?**

The Science curriculum leader is responsible for designing the Science curriculum and monitoring implementation.

The subject leader’s monitoring is validated by senior leaders.

Staff have regular access to professional development/training to ensure that curriculum requirements are met.

Effective assessment informs staff about areas in which interventions are required. These interventions are delivered during curriculum time to enhance pupils’ capacity to access the full curriculum.

Curriculum resources are selected carefully and reviewed regularly.

Assessments are designed thoughtfully to assess student progress and also to shape future learning.

Consistency, accuracy and reliability of assessments are validated through standardisation, which is then quality assured by the Science curriculum leader.

Members of the department mark for the AQA, OCR and Edexcel exam boards and provide CPD to the rest of the department to improve reliability of data.

Gap analysis is used following summative assessments to inform subsequent teaching, identify gaps in knowledge and plan more specific, targeted intervention if required.

**How do we make sure our curriculum is having the desired impact?**

* Examination results analysis and evaluation, reported to the senior leaders and the local governing body to ensure challenge
* Termly assessments-analysis and evaluation meetings
* Lesson observations
* Learning walks
* Book scrutiny
* Regular feedback from Teaching Staff during department meetings
* Regular feedback from Middle Leaders during curriculum meetings
* Pupil surveys
* Parental feedback
* External reviews and evaluations