Sandhill View

Science Curriculum Policy

Aspire, Achieve, Enjoy

Academy Aim

Here at Sandhill View 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. Ultimately, we want students to '***Know More, Do More and Go Further'***

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 vital to the world's future prosperity, and our curriculum allows students to develop and apply their substantive knowledge, disciplinary knowledge and discover and participate within STEM careers. 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 scheme is planned to be interleaved with prior and future learning to support students' understanding of the most complex concepts.

The curriculum aims for pupils to:

- Develop scientific substantive knowledge;
- 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 apply disciplinary knowledge such as: 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.

Each topic within the programme of study has a career attached which is covered, in detail, on a local, national, and global level. In addition to subject specific links, we aim to explicitly reinforce the skills and aptitudes which employers say are important in the workplace;

- Resilience (Aiming High, Staying Positive);
- Collaboration (Teamwork, Leadership, Listening, Speaking);
- Creativity (Problem Solving).

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

COVID Recovery 'Unlocking Learning'
As the impact of COVID is now impacting on students who missed learning during KS2 all students complete a baseline assessment upon entering the Science curriculum in September. This allows for an understanding of the gaps in pupil knowledge and how to further support their progress in future planning. Many students missed the opportunity to complete practical activities that further develop their disciplinary knowledge and therefore an emphasis on students accessing practical experimental work is made. Students complete skills-based units throughout Year 7 and Year 8 to support student transition to Secondary education.

Literacy

We know that students who read well achieve well. As such all subject areas are committed to providing regular opportunities to read extensively. In Science we provide opportunities for students to read Tier 2 and Tier 3 vocabulary with an emphasis on comprehension and application. We also support our students to use ambitious vocabulary including using Frayer models and 'push' techniques to widen the vocabulary students can confidently include in the work they produce. Coherent and fluent writing skills are also imperative for student achievement, so we support student writing skills by offering opportunities for extended writing, with modelling, and sentence stems to support.

The Key Stage 3 Science Curriculum:

KNOW MORE: Our Key Stage 3 Science Curriculum includes the following areas of study:

Three year KS3 where students complete the KS3 National Curriculum as well as bridging topics known as 'Fundamentals' to support students accessing KS4. There are 8 hours per fortnight for Year 7 & 8, and then 10 hours per fortnight for Year 9.

KS3	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6
Year 7	*Topic title and key concept:* *Introduction to Science – a topic focused on key scientific apparatus and practical skills.* **Substantive Knowledge: What are key pieces of apparatus and how are they used?** Disciplinary knowledge Students complete	*Topic title and key concept:* *Particle Model – the three states of matter and the processes of changing between them. This unit also includes a focus on gases and how they exert pressure on objects.* **Substantive Knowledge: What are the three states**	*Topic title and key concept:* *Speed – this topic focuses on calculating and investigating speed of objects and how this can be represented graphically. There are also links to changes in speed and*	*Topic title and key concept:* *Earth's Structure – a topic focussed on how rocks are formed including the composition of the Earth and specific formations such as ceramics.* **Substantive Knowledge: How are**	*Topic title and key concept:* *Human reproduction – the study of how humans develop as they go through puberty as well as the parts of the reproductive systems and how fertilisation and gestation occur. Students also discuss contraception and infertility.*	*Topic title and key concept:* *Elements – an introduction to atoms, elements, and compounds and how these are written as scientific notifications.* **Substantive Knowledge:** **What is the difference between**

	practical activities including lighting a bunsen burner, heating water, making a flare as well as labelling key scientific apparatus and introductions to hazard symbols and their meanings. Cross-curricular knowledge: Links to maths – reading from a scale. *Topic title and key concept:* *Cells – the study of animal and plant cells and their organelles including specialised cells in animals and plants. Students also focus on key concepts such as diffusion to link with substances entering and exiting cells.* **Substantive Knowledge: What is the structure and function of organelles in different cells?** Disciplinary knowledge: Practical	**of matter and what are the processes involved in changing between them?** Disciplinary knowledge: Practical activities include melting and freezing substances and measuring the temperature of this. Demonstrations of gas pressure are also used to integrate learning with practical observations. Cross-curricular knowledge: Graph skills link with maths *Topic title and key concept:* *Separating mixtures – the study of compounds and mixtures and scientific techniques used to separate them.* **Substantive Knowledge:**	*the ideas of acceleration.* **Substantive Knowledge: How can speed be measured, calculated, and represented graphically?** Disciplinary knowledge: There is a practical investigation included in this topic that focuses on calculating speed by measuring the distance travelled and time of a moving object. Students also work on graphs representing journeys as both distance-time and velocity-time graphs. There are also opportunities to use equations and calculate speed, and acceleration from formula. Cross-curricular	**rocks formed?** Disciplinary knowledge: Practical investigations in this unit include reactions of metals and rocks to observe their composition. Cross-curricular knowledge: Links to geography and outdoor learning but studying how rocks are formed and how this rock cycle leads to changes in rock formation. *Topic title and key concept:* *Universe – this topic consists of objects in the night sky and the night sky as well as how they influence our understanding of phenomena on earth such as the seasons and*	**Substantive Knowledge: How do animals reproduce?** Disciplinary knowledge: Students look at models of concepts such as gestation, conception and discuss ethical issues with contraception and infertility Cross-curricular knowledge: Links to child development and the gestation period of the foetus *Topic title and key concept:* *Variation – this topic focusses on the variation within species and how this variation can be beneficial for evolution* **Substantive Knowledge: How does variation occur in humans?** Disciplinary knowledge: Students	**atoms, elements, and compounds and how are these represented ?** Disciplinary knowledge: Students can complete practical activities focussing on conservation of mass and how this links to word equations Cross-curricular knowledge: Links to maths for balancing equations *Topic title and key concept:* *Periodic Table – A study of the properties of elements in different groups based on their positions in the periodic table.* **Substantive Knowledge:** **How is the periodic**

	activities in this topic include preparing slides of animal and plant cells and viewing these under a microscope. Students can also complete calculations of magnification for microscopic samples. Cross-curricular knowledge: Links to adaptations of cells including single celled organisms to Geography *Topic title and key concept:* *Movement – the study of how the human body facilitates movement including joints, muscles, and bones.* **Substantive Knowledge: How do muscles, bones, and joints create movement in the human body?** Disciplinary knowledge: Practical activities include a muscle	**How can mixtures be separated based on their component substances?** Disciplinary knowledge: There are several practical activities in this topic including filtering insoluble solids and solvents, crystallisation of soluble solids and solvents, distillation of mixtures of liquids, and chromatography used to separate colours. Students also focus on scientific method including planning practical methods and graph skills. Cross-curricular knowledge: Links to graph skills covered in the maths curriculum	knowledge: Links to the maths curriculum through the speed = distance/time equation as well as calculating acceleration using the rearrangement of formula and substitution. *Topic title and key concept:* *Interdependence – students study the relationships between predators and prey and how they connect through food chains and food webs. There is also a focus of how humans affect these including using chemicals such as pesticides and fertilisers.* **Substantive Knowledge: How are animals and plants connected?**	*the phases of the moon* **Substantive Knowledge: What is the composition of space?** Disciplinary knowledge: A practical investigation into the impact of meteors on the surface of the Earth and how scientists can determine information about these meteors from their craters. Cross-curricular knowledge: Links to the mathematics curriculum including calculations of orbits *Topic title and key concept:* *Energy costs and transfers – how electricity is generated and the cost of this to people* **Substantive Knowledge:**	investigate environmental and inherited characteristics and how this variation is representative of the human population Cross-curricular knowledge: Links to the mathematics curriculum through the study of data; continuous and discontinuous and how it can be displayed	**table organised?** Disciplinary knowledge: Students complete a practical investigation of the properties of group 1 metals. Students complete an investigation into displacement reactions. Cross-curricular knowledge: Links to engineering and the properties of materials *Topic title and key concept:* *Acids and alkalis – this topic focus on testing for acids and alkalis as well as indicators and how neutralisation reactions occur.* **Substantive Knowledge: How can we identify**

	strength practical focussing on antagonistic muscles. Cross-curricular knowledge: Links to PE and muscle strength including how muscles can be built through exercise.	*Topic title and key concept:* *Gravity – the study of gravity, mass, and weight and the physical laws that connect them.* **Substantive Knowledge:** **How are mass, weight, and gravity connected?** Disciplinary knowledge: Practical activities include measuring forces using newton meters for different masses to determine the value of gravitational field strength on Earth. Students are also able to draw conclusions from demonstrations of objects falling in a vacuum. Cross-curricular knowledge: Links to using and	Disciplinary knowledge: Students develop their understanding of scientific diagrams and how they can be explained Cross-curricular knowledge: Links to the geography and outdoor learning curriculum through the use of fertilisers and pesticides and how they lead to bioaccumulation *Topic title and key concept:* *Plant reproduction – the main reproductive organs in plants and how they lead to pollination and germination.* **Substantive Knowledge: How do plants reproduce?**	**What does it cost to generate electricity?** Disciplinary knowledge: The development of mathematical skills by calculating energy in various scenarios Cross-curricular knowledge: Links to engineering and how electricity is generated in power stations		**acids and alkalis?** Disciplinary knowledge: Students investigate different indicators and test chemicals to discover if they are acidic or alkaline. Students will complete neutralisation reactions and discover what happens when acids and alkalis are combined. Cross-curricular knowledge: Links to food technology as students test some foods using different indicators *Topic title and key concept:* *Electricity – this topic includes circuit symbols and their uses as well as the concepts of potential difference,*

		rearranging equations with the maths curriculum as well as a focus on graph skills.	Disciplinary knowledge: Students complete a practical activity related to the shape of seeds and their dispersal methods including graphical skills, writing methods, apparatus, and writing conclusions and evaluations. Cross-curricular knowledge: Links to geography and outdoor learning for how plants spread their seeds and are fertilised by pollinators			*current and how static electricity is caused.* **Substantive Knowledge: How are circuits made and what materials can be used?** Disciplinary knowledge: Students make a variety of circuits using different components and test materials to see whether they can be used in electrical circuits. Cross-curricular knowledge: Links to engineering and electrical circuits
Year 8	*Topic title and key concept:* *Light waves – light is a wave that transfers*	*Topic title and key concept:* *Digestion: the main nutrients found in food*	*Topic title and key concept:* *Photosynthes is – the study*	*Topic title and key concept:* *Contact forces – the*	*Topic title and key concept:* *Inheritance – students develop their*	*Topic title and key concept:* *Climate – the study of the Earth's*

	energy from a luminous object. Light travels in straight lines and can reflect and refract based on the density and surface of an object. **Substantive Knowledge: What is light and how does it travel?** <u>Disciplinary knowledge: Practical activities include investigating angles of reflection as well as angles of refraction. Students also focus on improving their mathematical skills by using a protractor to measure angles.</u> Cross-curricular knowledge: Links to mathematics and measuring angles using a protractor *Topic title and key concept:* *Sound waves: sound is a longitudinal wave that requires a medium to travel through.*	*and how are they broken down in the body.* **Substantive Knowledge: What is a balanced diet and how does our body digest food?** <u>Disciplinary knowledge: The main practical activity is testing foods for different nutrients including how to recognise positive tests.</u> Cross-curricular knowledge: Links to catering and a balanced diet. *Topic title and key concept:* *Breathing: What the composition of the air is and how gases travel through the body to the alveoli to be diffused into the blood.* **Substantive Knowledge: What is the**	*of the process of photosynthesis and some factors that can affect the rate* **Substantive Knowledge: How do plants produce glucose?** <u>Disciplinary knowledge: Students investigate some factors that affect the rate of photosynthesis</u> Cross-curricular knowledge: Links to geography and adaptations of plants for different climates *Topic title and key concept:* *Chemical Energy – this topic focusses on energy changes during chemical reactions and*	*study of forces and how forces can cause movement when they are not in equilibrium* **Substantive Knowledge How do different forces affect objects?** <u>Disciplinary knowledge: Students complete practical activities focussing on elastic objects, as well as drag forces for solids, and liquids.</u> Cross-curricular knowledge: Links to engineering based on moments and the effect of turning forces. *Topic title and key concept: Pressure – this topic studies pressure in solids, liquids, and*	*understanding of genetics including the history of DNA and how characteristics are inherited* **Substantive Knowledge: What is the structure of DNA?** <u>Disciplinary knowledge: Students develop their understanding of data by focussing on continuous and discontinuous data and how this is displayed</u> Cross-curricular knowledge: Links to the maths curriculum and displaying data *Topic title and key concept:* *Evolution – the study of how DNA inheritance can cause changes in species over time* **Substantive Knowledge: What is the process of evolution?**	*atmosphere, changes to this including climate change and how the carbon cycle is affected by living organisms* **Substantive Knowledge: What is the carbon cycle and how do humans affect it?** <u>Disciplinary knowledge: Students develop their understanding of data by focussing on analysing graphs showing carbon dioxide levels in the atmosphere over time</u> Cross-curricular knowledge: Links to Geography and how the changing climate affects populations *Topic title and key concept:* *Earth's resources –*

	Students focus on the pitch and loudness of sounds and how oscilloscope traces represent sound waves as well as uses of sound waves by humans and animals. **Substantive Knowledge:** **How can the pitch and loudness of sound waves be changed?** Disciplinary knowledge: Teacher led demonstrations of sound in a vacuum. Cross-curricular knowledge: Links to pitch and loudness of sound waves to Music	**process of breathing?** Disciplinary knowledge: Students completed skills work on measuring their lung volume and comparing this to other body qualities such as height. Cross-curricular knowledge: Links to PE and the effect of exercise on the body. *Topic title and key concept:* *Respiration: the study of the process of respiration including the different types and how it is used to make products such as alcoholic drinks and bread.* **Substantive Knowledge: What are the different types of respiration and how are they used?**	*how this can be measured* **Substantive Knowledge:** **What are endothermic and exothermic reactions?** Disciplinary knowledge: Students complete a skills investigation focussed on temperature changes in chemical reactions. Students also focus on graph skills and representing data in different forms. Cross-curricular knowledge: Links to the mathematics curriculum through calculating means, and data analysis including graph skills *Topic title and key concept: Types of reaction – in*	*gases including some factors that affect this.* **Substantive Knowledge: What are factors that affect pressure in different changes of state?** Disciplinary knowledge: Students watch demonstrations of pressure in solids, liquids, and gases including how factors can affect pressure. Cross-curricular knowledge: Links to engineering as the use of hydraulics	Disciplinary knowledge: Students analyse data to identify changes in species over time Cross-curricular knowledge: Links to mathematics including displaying and analysing data	*students discover how metals are extracted from the Earth and how humans try to conserve these materials through recycling* **Substantive Knowledge: How are metals obtained?** Disciplinary knowledge: Students focus on extracting methods used by scientists and how these have changed over time Cross-curricular knowledge: Links to engineering and how metals are extracted from the Earth *Topic title and key concept: Metals and Non-Metals – the study of*

		Disciplinary knowledge: Practical activity on the effect of exercise on breathing rate and heart rate Cross-curricular knowledge: Links to PE and how respiration in exercise affects the body	*this topic students develop their understanding of chemical reactions including chemical and physical changes as well as thermal decomposition and combustion as examples of chemical reactions* **Substantive Knowledge: What are different types of chemical reactions?** Disciplinary knowledge: Students complete practical activities including combustion, and thermal decomposition. There is a development of student understanding of conservation of mass through investigations into mass changes.			*the reactions of metals and non-metals with other chemicals such as acids and oxygen.* **Substantive Knowledge: How do metals react with different chemicals?** Disciplinary knowledge: Students identify properties of metals and non-metals by testing them. There is also an investigation into the reactions of metals and acids and how this links to the reactivity series Cross-curricular knowledge: Links to mathematics and data analysis including calculating a mean and representing data in

			Cross-curricular knowledge: Links to geography relating changes of state to physical changes rather than chemical changes.			graphical forms. *Topic title and key concept:* *Electromagnets – the study of permanent and temporary magnets and how different materials are affected in their magnetic fields* **Substantive Knowledge: What are permanent and temporary magnetic fields?** <u>Disciplinary knowledge: Students test different materials to discover magnetic and non-magnetic materials. Students also complete a skills investigation into factors that affect the strength of temporary magnetic fields</u> Cross-curricular knowledge:

						Links to engineering and the development of locking mechanisms as well as loudspeakers and microphones using the motor effect
Year 9	*Topic title and key concept:* *Fundamentals: The Body – Students develop their understanding of cells by studying prokaryotes and eukaryotes and viewing cells under a microscope. Students also link the movement of substances in and out of cells to the processes the substances are involved in. Students also look at the movement of pathogens into the body and the recognisable symptoms they produce in the body.* **Substantive Knowledge: What substances move into and out of**	*Topic title and key concept:* *Fundamentals: Materials - Students develop their understanding of elements, compounds, and mixtures including how mixtures are separated. Students also focus on the layout of the periodic table and the mass and formula of compounds.* **Substantive Knowledge: What are elements, compounds, and mixtures and how are elements displayed on the periodic table?** Disciplinary knowledge: Practical activities in this topic include	*Topic title and key concept:* *Fundamentals: Energy Transfers – students work on describing and calculating energy transfers and link this to electric circuits. Students also discover how forces are involved in energy transfers and how reaction time and stopping distance are affected by different factors* **Substantive Knowledge: What are energy transfers and how are they described in**	*Topic title and key concept:* *Fundamentals: Plants – students develop their understanding of plants by looking at plant tissues and organ systems. The topic includes the equation for photosynthesis and biotic and abiotic factors that affect plants.* **Substantive Knowledge: What are factors that affect plant tissues and organs?** Disciplinary knowledge:Practical activities for this topic can include	*Topic title and key concept:* *Fundamentals: Reactions – Students investigate how to identify gases produced in chemical reactions such as the conservation of mass examples. This topic also includes a study of the process of electrolysis and separating ionic compounds.* **Substantive Knowledge: What are the tests for different gases?** **How does electrolysis separate ionic compounds?** Disciplinary knowledge:	*Topic title and key concept:* *Fundamentals: Atoms – students discover how different materials can change between states and link this to the density of the substance. Students also focus on the structure of the atom and how our model of the atom has developed over time.* **Substantive Knowledge: How is the density of objects affected by changes of state?** **What is the structure of the atom and how has our modelling of**

	organisms and how are they used? Disciplinary knowledge: Students use microscopes to view a variety of cells and practice preparing slides for viewing. Practical investigations also include changes in mass related to osmosis. Cross-curricular knowledge: Links to the mathematics curriculum related to changes in mass and data analysis of trends in diseases over time.	separation techniques including distillation and chromatography as well as practical applications of conservation of mass Cross-curricular knowledge: Links to the mathematics curriculum during calculations of relative formula mass	**different scenarios?** Disciplinary knowledge: Practical activities include an investigation into the relationship between weight and mass Cross-curricular knowledge: Links to the mathematics curriculum through the substitution and rearrangement of equations for calculating energy transfers	viewing stomata under a microscope and observing photosynthesis is related to factors that may affect it Cross-curricular knowledge: Links to Geography related to biotic and abiotic factors for plant growth.	Students can benefit from demonstrations of chemical reactions that produce gases and what positive tests for each gas are. Students can also complete investigations into electrolysis. Students can complete practical investigations into endothermic and exothermic reactions and how these reactions are measured using temperature changes Cross-curricular knowledge: Links to engineering and the extraction of metals using electrolysis	**this changed over time?** Disciplinary knowledge: Students focus on the development of atomic models and how these models have changed based on evidence gathered through scientific investigation Cross-curricular knowledge: Links to engineering related to the density of different materials and their uses

KNOW MORE: Our Key Stage 4 Curriculum

The KS4 Curriculum is taught over 2 years. Y10 and Y11 have 12 hours of Science per fortnight. 11/Sc1 complete AQA GCSE Separate Science (8461, 8462, 8463) whilst all other classes complete AQA GCSE Combined Science (8464).

KS3	Half Term 1	Half Term 2	Half Term 3	Half Term 4	Half Term 5	Half Term 6

Year 10	*Topic title and key concept:* *Infection and Response – the study of pathogens and the diseases they cause. Students also cover phagocytosis and body responses to infection and how scientists use vaccines to promote immunity.* **Substantive Knowledge: What is a pathogen and how do they affect our bodies?** **How does our body respond to infection?** <u>Disciplinary knowledge: Students can use microbiology techniques to prepare agar jelly plates and grow bacteria. Students may also look at the effectiveness of antibiotics on these bacterial growths.</u> Cross-curricular knowledge: Links to History and the development of	*Topic title and key concept:* *Particle Model of Matter – this topic focuses on the three states of matter and changes of state including changes to the internal energy of substances and how these are represented graphically. Students also calculate specific heat capacity and specific latent heat and relate this to heating and cooling curves.* **Substantive Knowledge: What is internal energy and how is it calculated?** <u>Disciplinary knowledge: Students complete practical activities measuring the density of regular and irregular objects. Students can also benefit from measuring the density of</u>	*Topic title and key concept:* *Chemical changes – Students investigate metals including how they are extracted from the Earth and then discover reactions of metals and acids as well as neutralisation and salt production. Students link this idea of salt production to the separating of salts using electrolysis and discuss how the products of electrolysis differ depending on whether the substance is molten or in solution.* **Substantive Knowledge:** **How are metals extracted from ores and from compounds ?** **How can scientists**	*Topic title and key concept:* *Homeostasis - the study of internal body conditions and the regulation of these including blood glucose levels, temperature, and water levels. An in depth look at the endocrine system and how hormones affect reproductive systems and how artificial hormones are used in contraception* **Substantive Knowledge:** **How are body conditions controlled by hormones?** <u>Disciplinary knowledge: Students investigate reaction time and factors that can affect this including the intake of</u>	*Topic title and key concept:* *Rate and Extent of Change – students investigate rates of reaction in this topic including factors that can increase or decrease this rate. Students also cover dynamic equilibrium and Le Chatelier's principle and how this is used in industry to produce products such as ammonia.* **Substantive Knowledge:** **What are factors that affect rates of reaction?** <u>Disciplinary knowledge:</u> <u>Practical activities in this topic are varied and include an evaluation of how to collect gas released from a chemical reaction in the most accurate manner. Students investigate how concentration, temperature, or</u>	*Topic title and key concept:* *Forces – the study of contact and non-contact forces and how these forces can be measured and calculated in various scenarios. Students also study the motion of objects and calculate the velocities and accelerations of objects.* **Substantive Knowledge:** **What are forces and how can they be calculated?** **How can the motion of objects be described and quantified based on the forces acting on it?** <u>Disciplinary knowledge: There are a variety of practical activities in this topic including the measurement</u>

	medicine over time *Topic title and key concept:* *Quantitative Chemistry – students focus on calculations related to chemical reactions including conservation of mass.* **Substantive Knowledge: What is conservation of mass?** Disciplinary knowledge: Students can benefit from demonstrations and practical investigations where mass appears to change during a chemical reaction Cross-curricular knowledge: Links to the mathematics curriculum related to using equations (rearranging and substitution)	liquids. Students investigate the specific heat capacity of different materials and practice setting up electric circuits and taking measurements from these. Students can also measure temperature changes during changes of state to create their own heating or cooling curves. Cross-curricular knowledge: Links to the mathematics curriculum related to the displaying of data for heating or cooling curves as well as calculations using equations including rearranging and substitution. *Topic title and key concept:* *Bioenergetics – this topic focusses on photosynthesis and respiration which are the*	**determine if a substance is acidic or alkaline and what is neutralisation?** Disciplinary knowledge: Practical activities for this topic include neutralisation reactions producing different salts as well as reactions between acids and metals and the products of these. Students can also investigate electrolysis of different substances and discover the products of electrolysis. Cross-curricular knowledge: Links to engineering and the extraction of metal from ores in the Earth	caffeine and distractions. Cross-curricular knowledge: Links to the PE curriculum measuring reaction time	surface area affect rates of reaction. Cross-curricular knowledge: Links to Outdoor Learning and the production of fertilisers using dynamic equilibrium	of weight and mass to determine the value of gravitational field strength on Earth. Students investigate acceleration and how the force applied to an object can increase its acceleration proportionally . Cross-curricular knowledge: Links to the mathematics curriculum as students rearrange, substitute and calculate quantities using equations

		two main processes in living things. Students investigate factors that affect photosynthesis and discuss the uses of glucose in plants as well as different types of respiration and uses of these. **Substantive Knowledge: How do living things produce glucose and release energy from it?** Disciplinary knowledge: Students investigate factors that affect photosynthesis including light intensity and wavelengths of light. Students also observe the presence of starch in leaves as storage of glucose from photosynthesis. There are opportunities to investigate respiration including anaerobic respiration	*Topic title and key concept:* *Energy Changes – this topic focusses on energy changes in chemical reactions such as endothermic and exothermic reactions with students representing these graphically as reaction profiles and calculating bond energies.* **Substantive Knowledge:** **What are energy changes in chemical reactions and how can they be mathematic ally represented ?** Disciplinary knowledge: Practical investigations in this topic include endothermic and exothermic			

		using yeast cells. Cross-curricular knowledge: Links to food technology and how fermentation as an example of anaerobic respiration is used in the food industry.	reactions and the measurement of temperature changes during these reactions. Students can then represent these graphically. Cross-curricular knowledge: Links to the mathematics curriculum including calculations of bond energies and reaction profile graph analysis *Topic title and key concept:* *Atomic Structure – this topic focusses on nuclear radiation including the structure of the atom and how radiation is released as well as properties of the different types of radiation* **Substantive Knowledge: What is**			

			nuclear radiation and what are its properties? Disciplinary knowledge: Students discuss models of the atom and how observational evidence has caused scientists to change these models. Students also use a modelled example to investigate half-life of nuclear radiation samples. Cross-curricular knowledge: Links to the mathematics curriculum including exponential graphs and how to interpret these.			

Year 11	*Topic title and key concept:* *Rate and Extent of Change – students investigate rates of reaction in this topic including factors that can increase or decrease this rate. Students also cover dynamic equilibrium and Le Chatelier's principle and how this is used in industry to produce products such as ammonia.* **Substantive Knowledge: What are factors that affect rates of reaction?** <u>Disciplinary knowledge:</u> <u>Practical activities in this topic are varied and include an evaluation of how to collect gas released from a chemical reaction in the most accurate manner. Students investigate how concentration, temperature, or surface area</u>	*Topic title and key concept:* *Inheritance and Variation – this topic focuses on DNA and how this is passed on through sexual and asexual reproduction. Students also discover how characteristics are inherited and that variation in species can lead to evolution in a species and how species that are unable to evolve risk becoming extinct.* **Substantive Knowledge: What is the structure of DNA and how is it replicated?** **What is evolution and how can organisms evolve over time?** <u>Disciplinary knowledge:</u> <u>Students have the opportunity to create models of the double helix</u>	*Topic title and key concept:* *Chemical analysis – students discover how chemical analysis techniques can be used to determine the presence of different gases as well as soluble substances found in chromatograms. Students also work on chemical measurements such as spectroscopy and identifying ions in substances.* **Substantive Knowledge: How can scientists identify unknown substances using chemical analysis?** <u>Disciplinary knowledge:</u> <u>Students create their own chromatograms and use these to determine</u>	*Topic title and key concept:* *Chemistry of the Atmosphere – a study of the composition of our atmosphere and how this has changed over the history of the Earth as well as the impact of humans on this.* **Substantive Knowledge: How has the Earth's atmosphere changed over time and how have humans affected these changes?** <u>Disciplinary knowledge:</u> <u>Students can analyse data representations of changes to the atmosphere of the Earth</u> Cross-curricular knowledge:	*Students will be focussing on preparing for their Summer Examinations*	*Students will have left after their Summer Examinations*

	affect rates of reaction. Cross-curricular knowledge: Links to Outdoor Learning and the production of fertilisers using dynamic equilibrium *Topic title and key concept:* *Forces – the study of contact and non-contact forces and how these forces can be measured and calculated in various scenarios. Students also study the motion of objects and calculate the velocities and accelerations of objects.* **Substantive Knowledge:** **What are forces and how can they be calculated?** **How can the motion of objects be described and quantified based on the forces acting on it?**	structure of DNA. Students use various models to show the process of evolution and how a change in environment and variation do not always lead to an organism evolving. Cross-curricular knowledge: Links to the History curriculum through the study of genetic inheritance and how lineages used genetic inheritance to determine heirs *Topic title and key concept:* *Organic Chemistry – the study of organic chemicals collected from crude oil and separated in fractional distillation. Students studying separate science also study various reactions of*	the composition of different substances. Students can also complete gas tests to determine results of positive tests for different gases. Students studying Separate Science can evaluate different substances for the ions which they contain using flame tests and spectroscopy . *Topic title and key concept:* *Waves – the study of energy transfers in the form of transverse and longitudinal waves. Students discover more about the family of waves known as the electromagnetic spectrum and how these are*	Links to the mathematics curriculum as students analyse graphical representations of the Earth's atmosphere *Topic title and key concept:* *Using Resources – a study of sustainability and the environmental impact of products over their life time including minimising damaging effects.* **Substantive Knowledge:** **What is the impact of products over their life cycle? How can the impact of products be reduced over time?** Disciplinary knowledge: Students investigate how potable water is made and the processes		

	Disciplinary knowledge: There are a variety of practical activities in this topic including the measurement of weight and mass to determine the value of gravitational field strength on Earth. Students investigate acceleration and how the force applied to an object can increase its acceleration proportionally. Cross-curricular knowledge: Links to the mathematics curriculum as students rearrange, substitute and calculate quantities using equations	*these hydrocarbons and how we use them to make substances such as carboxylic acids, esters, alcohols and polymers.* **Substantive Knowledge:** **What is crude oil and what does it contain?** **How can crude oil be separated?** Disciplinary knowledge: Students can test substances to discover if they are alkanes or alkenes using bromine water. Cross-curricular knowledge: Links to engineering and the use of different substances in crude oil being used as fuels	*used in various employment sectors.* **Substantive Knowledge:** **What are different types of waves and what are they used for?** Disciplinary knowledge: Transverse and longitudinal waves are modelled by teaching staff to demonstrate this unobservable phenomenon. Students participate in calculating the speed of a wave based on measuring the wavelength and frequency of a water wave and a standing wave. Cross-curricular knowledge: Links to the IT curriculum	involved in treating sewage water and ground water. Cross-curricular knowledge: Links to Geography and the environmental impact of products *Topic title and key concept:* *Electromagnetism – a study of magnetic fields and the link between electricity and magnetism* **Substantive Knowledge: What are permanent and temporary magnets and the factors that affect the strength of their fields?** Disciplinary knowledge: Students are given the opportunity to investigate permanent		

			and uses of electromagnetic waves in transmitting data *Topic title and key concept:* *Ecology – the study of living organisms in communities and how these communities interact and affect each other. Students study scientific techniques such as sampling and discuss how sampling can be used to identify populations in an area.* **Substantive Knowledge: How do populations interact with each other and what factors affect communities?** Disciplinary knowledge: Practical activities include sampling techniques	and temporary magnets including which materials they affect and factors that can increase the strength of the magnetic fields. Students studying Separate Science also investigate the motor effect and how this generates movement. Cross-curricular knowledge: Links to the mathematics curriculum using equations including rearranging, substituting, and calculating different quantities.		

			where students estimate population numbers and discuss factors that can affect these populations. Students also study a variety of graphical representations of changes to populations over time. Cross-curricular knowledge: Links to the mathematics curriculum as students analyse graphs. Links to the Geography curriculum and the factors that affect living communities.			

DO MORE: Milestone assessment end points

Disciplinary knowledge in Science is often discussed as 'Working Scientifically' which has a range of skills related to practical work, modelling, analysis, and evaluation. The end points for this knowledge is split into different categories as shown below.

However, students must also be able to complete skills such as applying knowledge, evaluating data and hypotheses, explaining key concepts, and defining key terms. Below are end points for each of the year groups and topics based on these core skills.

Year 7

Basic	Clear	Detailed

Safety and Risk Recognise risks when prompted **Apparatus** Identify basic apparatus used in investigations **Method** Suggest ways to investigate a question **Variables** Name the three variables **Graphs** Label axes on a basic line or bar graph **Conclusion and Evaluation** Identify straightforward patterns in data **Scientific method** Give examples of how scientific methods and theories have changed over time Recognise/draw/interpret diagrams	**Safety and Risk** Act on suggestions to minimise risk **Apparatus** Choose correct equipment from a selected list with prompts **Method** Hypothesise a result based on an investigation **Variables** Name a control variable from a list of variables **Graphs** Label units on axes on basic line or bar graphs **Conclusion and Evaluation** Make simple conclusions **Scientific method** Identify methods that can be used to tackle problems caused by human impacts on the environment Translate data to a representation with a model	**Safety and Risk** Independently recognise risks **Apparatus** Independently choose the correct equipment **Method** Suggest ways to investigate a question **Variables** Identify variables that are difficult to control **Graphs** Plot points on basic line or bar graphs **Conclusion and Evaluation** Suggest ways to improve a method Identify anomalies **Scientific method** Describe specified examples of the technological applications of science Describe methods that can be used to tackle problems caused by human impacts on the environment

Year 8

Basic	Clear	Detailed
Safety and Risk Act on suggestions to minimise risk **Apparatus** Choose correct equipment from a selected list with prompts **Method** Hypothesise a result based on an investigation **Variables** Name a control variable from a list of variables **Graphs** Label units on axes on basic line or bar graphs **Conclusion and Evaluation** Make simple conclusions **Scientific method** Identify methods that can be used to tackle problems caused by human impacts on the environment	**Safety and Risk** Independently recognise risks **Apparatus** Independently choose the correct equipment **Method** Suggest ways to investigate a question **Variables** Identify control variables independently **Graphs** Plot points on basic line or bar graphs **Conclusion and Evaluation** Suggest ways to improve a method Identify anomalies **Scientific method** Describe specified examples of the technological applications of science	**Safety and Risk** Describe risks during specific practical work Identify hazards associated with risks **Apparatus** Draw the set up of apparatus in specific investigations **Method** Describe a basic method including measurements that must be taken Describe a basic method including ranges and intervals **Variables** Recognise which variables to control, measure, and change **Graphs** Draw a line graph with support **Conclusion and Evaluation** Describe trends in graphs Describe trends in data

Translate data to a representation with a model	Describe methods that can be used to tackle problems caused by human impacts on the environment	Use data in conclusions **Scientific method** Explain why new data from experiments or observations led to changes in models or theories Use models in explanations or match features of a model to the data from experiments or observations that the model describes or explains Explain specified examples of the technological applications of science

Year 9

Basic	Clear	Detailed
Safety and Risk Independently recognise risks **Apparatus** Independently choose the correct equipment **Method** Suggest ways to investigate a question **Variables** Identify variables that are difficult to control **Graphs** Plot points on basic line or bar graphs **Conclusion and Evaluation** Suggest ways to improve a method Identify anomalies **Scientific method** Describe specified examples of the technological applications of science Describe methods that can be used to tackle problems caused by human impacts on the environment	**Safety and Risk** Describe risks during specific practical work Identify hazards associated with risks **Apparatus** Draw the set up of apparatus in specific investigations **Method** Describe a basic method including measurements that must be taken Describe a basic method including ranges and intervals **Variables** Recognise which variables to control, measure, and change **Graphs** Draw a line graph with support **Conclusion and Evaluation** Describe trends in graphs Describe trends in data Use data in conclusions **Scientific method** Explain why new data from experiments or observations led to changes in models or theories Use models in explanations or match features of a model to the data from experiments or	**Safety and Risk** Independently recognise controls for specific risks and hazards **Apparatus** Describe how apparatus can be set up for practical investigations **Method** Describe a method including some of the variables **Variables** Explain why it is important to control variables to minimise errors **Graphs** Draw a line graph independently Identify anomalies on a line graph **Conclusion and Evaluation** Describe anomalies in terms of methodology Suggest practical improvements to methodology and data collection **Scientific method** Decide whether or not given data supports a particular theory Give examples of ways in which a model can be tested by observation or experiment Make predictions or calculate quantities based on the model or show its limitations

	observations that the model describes or explains Explain specified examples of the technological applications of science	

Year 10

Basic	Clear	Detailed
Safety and Risk Describe risks during specific practical work Identify hazards associated with risks **Apparatus** Draw the set up of apparatus in specific investigations **Method** Describe a basic method including measurements that must be taken Describe a basic method including ranges and intervals **Variables** Recognise which variables to control, measure, and change **Graphs** Draw a line graph with support **Conclusion and Evaluation** Describe trends in graphs Describe trends in data Use data in conclusions **Scientific method** Explain why new data from experiments or observations led to changes in models or theories Use models in explanations or match features of a model to the data from experiments or	**Safety and Risk** Independently recognise controls for specific risks and hazards **Apparatus** Describe measurements taken by different pieces of apparatus **Method** Describe a method including some of the variables **Variables** Explain the impact of not controlling specific variables **Graphs** Draw a line graph independently Identify anomalies on a line graph **Conclusion and Evaluation** Describe anomalies in terms of methodology Suggest practical improvements to methodology and data collection **Scientific method** Decide whether or not given data supports a particular theory Give examples of ways in which a model can be tested by observation or experiment Make predictions or calculate quantities based on the model or show its limitations	**Safety and Risk** Explain risks and how these can be controlled **Apparatus** Describe measurements taken by different pieces of apparatus **Method** Describe a full method including the three variables Explain choices such as intervals and ranges of different variables **Variables** Explain the impact of not controlling specific variables **Graphs** Draw curves of best fit **Conclusion and Evaluation** Identify quantitative relationships such as direct proportionality Critically interpret data **Scientific method** Evaluate methods that can be used to tackle problems caused by human impacts on the environment Suggest why the perception of risk is very often different from the measured risk

observations that the model describes or explains Explain specified examples of the technological applications of science		

Year 11

Basic	Clear	Detailed
Safety and Risk Independently recognise controls for specific risks and hazards **Apparatus** Describe how apparatus can be set up for practical investigations Describe measurements taken by different pieces of apparatus **Method** Describe a method including some of the variables **Variables** Explain the impact of not controlling specific variables **Graphs** Draw a line graph independently Identify anomalies on a line graph **Conclusion and Evaluation** Describe anomalies in terms of methodology Suggest practical improvements to methodology and data collection **Scientific method** Decide whether or not given data supports a particular theory Give examples of ways in which a model can be tested by observation or experiment Make predictions or calculate quantities based on the model or show its limitations	**Safety and Risk** Explain risks and how these can be controlled **Apparatus** Explain how precise measurements can be taken using different pieces of apparatus **Method** Describe a full method including the three variables Explain choices such as intervals and ranges of different variables **Variables** Explain the impact of not controlling specific variables **Graphs** Draw curves of best fit **Conclusion and Evaluation** Identify quantitative relationships such as direct proportionality Critically interpret data **Scientific method** Evaluate methods that can be used to tackle problems caused by human impacts on the environment Suggest why the perception of risk is very often different from the measured risk	**Safety and Risk** Create a risk assessment using suggested controls Create a risk assessment independently **Apparatus** Independently explain resolution of various apparatus **Method** Explain how your method will minimise errors Evaluate methods and suggest improvements that will affect accuracy **Variables** Explain independent and dependent variables in terms of ranges and intervals **Graphs** Read data from line or bar graphs **Conclusion and Evaluation** Evaluate conflicting evidence Justify improvements for methodology Suggest how to improve reliability of data Consider limitations in methodology and data collection **Scientific method** Explain that the process of peer review helps to detect false claims

		and to establish a consensus about which claims should be regarded as valid Explain that reports of scientific developments in the popular media are not subjected to peer review and may be oversimplified, inaccurate, or biased

GO FURTHER: Skills Builder

We are also explicitly embedding transferable 'Skills Builder' skills such as problem solving, aiming high and teamwork to prepare our students for higher education and employability skills for the future. This year in History we will focus on **TEAMWORK** including group decision making and recognising the value of others. **PROBLEM SOLVING** by exploring complex problems by analysing cause and effect, and understanding through research. Furthermore, we want our students to **AIM HIGH** by setting goals, prioritising tasks and involving others.

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 Science include:

- Seating to allow inclusion
- Scaffolding to stretch and support in all lessons
- Resources are accessible yet challenging
- Displays and visual learning tools are used where necessary
- Where appropriate, support from additional adults is planned to scaffold students learning
- Group work and discussion
- Clear teacher/student communication
- Feedback that allows students to make progress, whether written or verbal
- Independent study/homework.
- Intervention when required

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;

- work to identify barriers, interests and what might help each pupil make the next steps in learning.
- provide targeted support for under-performing pupils during lesson time, such as targeted questioning, live marking and seating
- ensure there are opportunities for students to make use of resources and gain homework support outside of lesson time through the use of Teams
- provide students with revision materials to reduce financial burden on families

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

- The Science curriculum leader is responsible for the design and implementation of the curriculum including quality assurance of lesson resources, schemes of learning, and assessments, as well as the monitoring and evaluation of this implementation to measure the impact.
- 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 and subject knowledge developed.
- 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, long term knowledge retrieval and also to shape future learning.
- Assessments are checked for reliability within departments and across the Trust.

There are several Science staff who mark for exam boards and provide vital CPD to the rest of the department to ensure reliability of data.

Gap analysis spreadsheets are used to identify areas of development for students at KS4 to identify areas of weakness. Enhanced results analysis is also used to identify departmental priorities for development to ensure students are making the highest progress.

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

- Examination results analysis and evaluation.
- Half-termly assessments based upon substantive and disciplinary knowledge covered during this time.
- Lesson observations.
- Learning walks for KS3 and KS4 based upon departmental priorities.
- Work sample for each year group.
- Regular feedback from teaching staff during department meetings.
- Regular feedback from Middle Leaders during curriculum meetings.
- Pupil Surveys.
- Parental feedback.
- Staff feedback through staff voice surveys.