



# Long Term Plan – Science

**Why study Science** - Science has changed our lives and is vital to the world’s future development, prosperity and health. All young people deserve to be taught the essential aspects of the knowledge, methods, processes and uses of science allowing them to understand, interpret and ultimately to make logical and informed decisions, today and tomorrow, for themselves and those they hold dear.

**Aims** - Through science, we aim to inspire our learners’ curiosity and provide them with the knowledge and skills to understand and explain the world around them. The Science Curriculum encourages pupils to ask and answer scientific questions, facilitate meaningful discussions on contemporary scientific issues and guide them to make their own connections through the wonder of science.

**Rationale for how the curriculum has been sequenced in Science** - At Key Stage 3, pupils follow a programme of study completing topics in the disciplines of Biology, Chemistry and Physics. It is designed to introduce pupils to the fundamental core scientific concepts, providing a solid foundation of knowledge which is to be built upon in future years. The topics for each year group have been specifically chosen so that pupil’s knowledge and skills are progressing through the year groups, ensuring full coverage of the national curriculum. Pupils will be encouraged to develop a sense of excitement and curiosity about natural phenomena. As well as developing an understanding of science, pupils will progress in the social aspects of learning through group investigations and practical experiments.

	Autumn 1	Autumn 2	Spring 1	Spring 2	Summer 1	Summer 2
<b>Year 7</b>	Introduction to Science at Shenley	7.2 Particle Theory	7.7 Atoms Elements and Compounds	7.5 Human Nutrition and Health	7.6 Energy	7.9 Ecosystems
	7.1 Cells	7.3 Space	7.4 Forces		7.8 Purity	
<b>Year 8</b>	8.1 Digestion	8.4 Sound Waves	8.3 Chemical Reactions	8.5 Matter	8.7 Earth’s Resources	8.9 Reproduction
	8.2 Neutralisation			8.6 Reproduction	8.8 Electricity	
<b>Year 9</b>	9.1 Respiration	9.3 Motion	9.4 Photosynthesis	9.6 Electromagnets	9.7 Organic	9.9 Light
	9.2 Metals		9.5 Bonding		9.8 Genetics	

## Progression through each discipline

Biology	Chemistry	Physics
<p style="text-align: center;"><b>7.1 Cells</b></p> <p>Students will learn that cells are the building blocks of living organisms. They will understand the components within a cell and their roles. They will then use microscopes to view some of the components, whilst understanding the limitations of the light microscope. Students will progress to know that there are different types of cells that are specialised to their roles. Furthermore, they will understand how and why substances move into and out of the cells. Finally, students will understand how cells work together on a larger scale to form tissues, organs and organ systems to carry out specific roles within the body.</p>	<p style="text-align: center;"><b>7.2 Particle Theory</b></p> <p>Students develop an appreciation that all matter consists of particles and that the arrangement and energy of the particles dictate the state of the substance. They will be able to describe and explain the interconversions between the 3 states of matter in terms of movement of the particles. Students will also be able to name these processes and discuss how the properties of each state are defined by the arrangement and energy of the particles within them.</p>	<p style="text-align: center;"><b>7.3 Space</b></p> <p>Space is a standalone composite at KS3 which introduces students to just how vast our universe is. Students will begin to appreciate where Earth; our home is in relation to the stars and other planets. Students will be able to explain the day, night, month, year and seasons on Earth based on observation of the motion of Earth, Moon, other planets and The Sun. Students will be able to:</p> <p>Name all the planets of the solar system.</p> <p>State and describe the action of gravity on Earth and other planets.</p> <p>Describe the big bang theory and provide evidence that supports the theory.</p>
<p style="text-align: center;"><b>7.5 Human Nutrition and Health</b></p> <p>Students will recall and build upon their knowledge of factors that affect human health. Following this, they will focus on diet in more detail, determining the nutrients required by the body and their role. Students will then progress to understand data related to food and how we can use this to help ensure we maintain a balanced diet. Students will understand how we can test for different nutrients within a food sample. In addition to diet, students will also consider the impact of drugs on human health, both negative and positive. They will then learn about the development of new drugs and the reasons behind</p>	<p style="text-align: center;"><b>7.7 Atoms Elements and Compounds</b></p> <p>Through the composite students will be building upon the foundations laid in 7.2 Particle Theory. They discover that the smallest particle of an identifiable substance is an atom. They progress to be able to describe elements, compound in terms of the atoms present and describe an element as a substance made up of only one type of atom. Compounds are formed when atoms of different elements chemically combine and obey the law of conservation of mass. They will be able to describe how the properties of an element are no longer observed</p>	<p style="text-align: center;"><b>7.4 Forces</b></p> <p>This composite will introduce students to forces. They will develop their ideas from composite 7.3 about gravity as a force. Students will learn to understand that forces are responsible for making objects move and change direction. The application of forces results in an object changing shape or its motion. Forces are always acting on objects, which can be represented using arrows and free-body diagrams. KS2 concepts of applied forces will be developed to enable students to understand:</p> <p>Resultant force can be calculated by adding forces acting in the same direction.</p> <p>Taking away forces acting in opposite direction.</p> <p>An object will move in the direction of</p>

each stage involved.	when the element reacts with another element to form a compound.	the bigger force.
<p style="text-align: center;"><b>7.9 Ecosystems</b></p> <p>Students will recall how energy is transferred through food chains and build upon this knowledge to learn that food chains combine to form food webs. They will progress to understand that organisms within an ecosystem compete for a range of resources and that they are dependent on each other for resources also. They will further this knowledge when they learn that organisms have adaptations which assist them with their roles within an ecosystem, and help them to survive. They will learn how to monitor biodiversity within an ecosystem and why this is important. They will understand how organisms interact on a larger scale with non-living factors around them, which results in the recycling of carbon. Finally, they will understand the impact of carbon on the atmosphere, and how this is affected by the human population.</p>	<p style="text-align: center;"><b>7.8 Purity</b></p> <p>Within this composite, students are taught to be able to identify a chemically pure substance as one made up of only a single substance, whether element or compound. This enhances the student understanding of matter which was first encountered in 7.1 Matter and further developed through the study of Atoms, Elements and Compounds in 7.7. Impure substances are known as mixtures eg air and can be readily separated as the substances in the mixture will possess differing physical properties eg boiling points. The method of separation is dependent upon the physical properties which differ between the mixtures components. They describe solutions as a mixture of solute and solvent, expanding upon particle theory to describe the process of dissolving.</p>	<p style="text-align: center;"><b>7.6 Energy</b></p> <p>Energy is the capacity to do work. Students will know from composite 7.4 that forces move objects. This will be developed during this composite to inculcate that forces, when applied transfer energy. Students will learn that energy cannot be made or destroyed; it can only be transferred from one form to another. Students will learn all the different stores of energy and develop this to understand the sources of electrical energy, how to generate electrical energy and costs associated with electrical energy. Ideas of particles from composite 7.2 will be used by students to explain thermal energy transfer in solids, liquids and gases. Students will learn about conducting and insulating materials in terms of particle arrangements and the movement of free electrons. They will know about electrons in atoms from composite 7.7.</p>
<p style="text-align: center;"><b>8.1 Digestion</b></p> <p>Students will start the topic by learning the parts of the digestive system and their roles. They will progress to look at the digestive system more closely, by focusing particularly on the structure and function of enzymes. This knowledge will be furthered when they learn about the specificity of enzymes with particular nutrients and how and why a range of factors can affect the productivity of enzymes in</p>	<p style="text-align: center;"><b>8.2 Neutralisation</b></p> <p>Solutions may be classified as acidic, alkaline or neutral using the pH scale which will also compare the relative strengths of acids and alkalis. Indicators can be used to measure pH and to monitor pH changes during neutralisation reactions. When acids react they produce salts; the salt may be soluble or insoluble depending upon the nature of the reactant. When an insoluble</p>	<p style="text-align: center;"><b>8.4 Waves Properties</b></p> <p>Students learnt about energy and energy transfer in composite 7.6. During this composite, students will add to their knowledge of energy transfer by learning about the properties of waves. Waves transfer energy from one point to another. Waves transfer energy either by the vibration of particles, which was introduced to students in composite 7.2, or thorough electromagnetic radiation which they will learn about in this composite.</p>

<p>general. Finally, students will understand how the digestive system is adapted for more efficient absorption of nutrients and will be introduced to the idea that the digestive system helps to obtain nutrients, to serve a greater purpose within the human body.</p>	<p>salt is formed a precipitate is formed. This composite is building upon the work previously studied in 7.7 Atoms, Elements and Compounds and introduces the concept that different chemical reactions can be grouped dependent upon the type of product formed.</p>	<p>Students will learn about the properties, examples and uses of the 2 types of waves: Transverse waves Longitudinal waves.</p>
<p style="text-align: center;"><b>8.6 Reproduction</b></p> <p>Students will progress to learn about another system within the human body; the reproductive system. This will start with relatable changes that occur to the body during puberty, as a result of hormones. Students will then learn that the purpose of these changes is to prepare male and female bodies for the process of reproduction. Students will learn the parts of the reproductive systems of both males and females. They will focus on the finer details of the menstrual cycle to determine its purpose in relation to reproduction. Following this, students will learn what happens throughout pregnancy and how the female body changes during birth. In addition to this, students will understand how a range of methods of contraception can prevent pregnancy. Finally, students will learn about the less relatable process of plant reproduction and how this knowledge can be used to our advantage as humans.</p>	<p style="text-align: center;"><b>8.3 Chemical Reactions</b></p> <p>Having been introduced to chemical reactions, when acids react in the preceding topic, 8.2 Neutralisation, students learn the nature of all chemical reactions in that reactants have bonds broken and new bonds form in the products made. Students develop a greater understanding of the concept that reactions produce products which exhibit different chemical and physical properties to the reactants from which they were made, which was first encountered in the 7.7 topic Atoms, Elements and Compounds.</p> <p>They find that bond breaking and bond forming both involve energy transfer.</p> <p>There is further classification of reaction types building on the introduction to this in 8.2 Neutralisation.</p>	<p style="text-align: center;"><b>8.5 Matter</b></p> <p>Students will be aware from composite 7.2 about the arrangement of particles in solids, liquids and gases. Students will also know from composite 7.6 that kinetic energy is the store of energy in any moving object. This composite will bring these concepts together for students to develop their knowledge on how the state of matter for any substance is determined by the kinetic energy and therefore the motion of particles in matter. Students will know that particles with high kinetic energy will have greater vibration, therefore are more likely to move further apart from one another. This causes an expansion or increase in volume of that substance. Students further develop this idea and are introduced to the concept of density. Students will know density is the amount of particles (mass) per unit area of a substance. The concept of pressure will be introduced in this composite. Students will use their knowledge of forces from composite 7.4 and develop this to understand that pressure in solids is the force applied per unit of area. Using their knowledge of particle motion from composite 7.2, students will learn that pressure in liquids and gases are caused by the particles applying a force on the walls of their containers. Students will also develop an</p>

		understanding of how gas pressure changes with changing temperature and volume of containers.
<p style="text-align: center;"><b>8.9 Pathogens</b></p> <p>Building on their knowledge of cells, students will learn that some cells can be harmful and others can be useful. They will learn about the structure and function of a range of pathogens. Students will progress to learn that pathogens can spread from one organism to another, and how this occurs. They will understand how the human body defends itself against a range of pathogens to prevent them from entering, and that when pathogens do enter the body, a second line of defence is triggered in the form of the immune system. They will learn how humans can manipulate this knowledge to prevent and treat diseases that the body is unable to fight off itself. They will understand that diseases also affect plants and that the plants also have defence mechanisms. Finally, students will investigate and analyse the growth of bacteria and the effectiveness of a range of antibiotics.</p>	<p style="text-align: center;"><b>8.7 Earth's Resources</b></p> <p>The make-up of our planet is described in terms of the three sections of the Earth. Students will be aware that the sections are there as a result of the manner in which the Earth was formed.</p> <p>The earth is still changing and evolving albeit over a geological timeframe via the rock cycle (the process of interconversions occurring between igneous, sedimentary and metamorphic rock types). Other processes evolving the nature of our planet are studied via the carbon cycle, a process which occurs in a more rapid time frame, and most recently through human activity. In particular human activity is adding to the greenhouse effect and ultimately causing Climate Change.</p> <p>The Human Activity described here mainly focuses on the use of fossil fuels in combustion reactions which were first encountered in 8.3 Chemical Reactions.</p>	<p style="text-align: center;"><b>8.8 Electricity</b></p> <p>Having been introduced to atoms and electrons in composite 7.7 and energy transfer in 7.6, students will know that electrons in atoms carry a negative charge. This composite will develop this concept and teach that current or static charge happens due to the flow of negatively charged electrons. When electrons flow they carry electrical energy from one place to another. The idea of free delocalised electrons, which was introduced in 7.6 will also be used to progress student's understanding of what makes a conducting and non-conducting material.</p> <p>Throughout this composite, students will be introduced to electrical circuit components and basic electrical circuit types. They will learn how simple circuits operate and how they are used to develop more complex electrical systems.</p> <p>Students will also learn about electrical safety and how to stay safe around electrical devices.</p>

<b>9.1 Respiratory and Circulatory System</b>	<b>9.2 Metals</b>	<b>9.3 Motion</b>
<p>Firstly, students will build on their knowledge of cell structure and digestion, to understand that cells require nutrients and a supply of Oxygen, in order to release energy through the process of aerobic respiration. They will then learn how the body can also carry out respiration without the presence of Oxygen and the limitations of this process. Building on their knowledge that the body requires Oxygen for respiration, students will learn about the process of breathing and the structures involved, in order to obtain this gas from the air. Students will further progress to understand the process of gas exchange in the alveoli and how alveoli are adapted for efficiency within this area. They will also understand how exercise can affect the body, which will help to introduce the idea of circulation. Students will learn about the components within blood and how blood vessels are structured in order to help them function efficiently. Students will then progress to learn about circulation on a larger scale, with focus on the structure and function of the heart and how it works in relation to the circulatory system as a whole. Finally, students will link this knowledge to previous learning about human health and how we can investigate this.</p>	<p>Metals are a finite resource which are extracted from ores which are found in the earth's crust. Students revisit the nature of Matter, 7.2, and 7.7 Atoms, Elements and Compounds through a study of metals.</p> <p>They develop their understanding to describe metals as a regular arrangement of positively charged metal ions in a sea of delocalised electrons. The nature of a metallic structure can be used to explain the properties which are exhibited by metals.</p> <p>They describe alloys as a mixture of metals and use particle theory to explain how alloying leads to changes in properties.</p> <p>Different metals have differing reactivity's which can be ranked in the reactivity series. The reactivity of a metal dictates the method used to extract the metal from its ore.</p> <p>Students will discuss the social, economic and cultural implications arising when mining, refining and recycling. There is much work here building on the foundations laid in 8.7 The Earth's Resources.</p>	<p>The concept of forces introduced to students in composite 7.4 will be recapped initially and this will then be developed to explain how forces determine the motion of objects. Students will learn how forces determine the following aspects of an object:</p> <p>Speed and acceleration Direction of travel Turning effect of the object about a pivot point</p> <p>Students will learn to calculate the speed, acceleration and turning effect of forces. Students will further progress to learn about momentum as a product of mass and speed of an object.</p>

<p style="text-align: center;"><b>9.4 Photosynthesis</b></p> <p>Relating back to learning on interdependence. Students will learn how the process of photosynthesis provides us with a supply of Oxygen, based on the reactants involved. They will then progress to understand how the leaf is adapted to obtain the reactants required as well as carrying out the process of photosynthesis. Students will investigate the factors that can affect the rate of photosynthesis to gain an understanding of how and why. Furthermore, students will understand how materials are transported from the roots and throughout the plant and finally the process of transpiration and how the rate of this can be affected.</p>	<p style="text-align: center;"><b>9.5 Bonding</b></p> <p>Students build on the nature of chemical reactions studied in 8.3 and write chemical equations to represent the reactants and products formed.</p> <p>They study group 1 and 7 of the periodic table and learn about the trends in the elements within these groups along with how a group 7 element would react with a group 1 element on a subatomic level.</p> <p>The resultant ionic product introduces the nature of ionic bonding and subsequently they learn how other substances can react and form covalent bonds.</p>	<p style="text-align: center;"><b>9.6 Magnetism &amp; Electromagnets</b></p> <p>This composite introduces the concept of magnetism and electromagnets. Student build on their knowledge of magnets being a non-contact force covered in composite 7.4. Students will learn about magnetic materials and the rules of magnetic attraction. Students will develop their knowledge of electricity conducting wires from composite 8.8 and progress to apply this in order to formulate a description of electromagnets. They will learn that electromagnets are simply a conducting wire carrying a current.</p> <p>Students will further develop ideas about how electromagnetism is used in the motor effect and in devices such as speakers, relay switches, electric bells and other such devices. Student will use the acquired knowledge to develop ideas on how to build a device using electromagnetism.</p>
<p style="text-align: center;"><b>9.8 Genetics</b></p> <p>For the final aspect of Biology, students will build on their knowledge of the nucleus within cells and be introduced to the more abstract concept of genetics. They will start with the structure, function and location of DNA within the human body. They will progress to understand that DNA can be a factor that leads to variation between organisms and that DNA is inherited from both parents. Students will further this knowledge with the more challenging process of genetic crosses, understanding how DNA from both parents can interact to determine characteristic of the offspring. Students will progress to understand how DNA can affect species on a greater scale during the process of evolution.</p>	<p style="text-align: center;"><b>9.7 Organic</b></p> <p>The formation of crude oil occurs from once living organisms, under specific conditions, over a time frame of millions of years. The resulting mixture is made up of different length hydrocarbon molecules.</p> <p>This mixture, like all others can be separated due to differences in the physical properties of the components in the mixture, in this case via the separating technique of Fractional distillation.</p> <p>The students study the nature of hydrocarbons and the different families they make up. The major products from the fractional distillation of crude oil are fuels. The students will learn to discuss the chemical</p>	<p style="text-align: center;"><b>9.9 Light</b></p> <p>Light is a store of energy, which is used by most mammals for vision. Students will learn how light enables the sensory organ; the eye to transduce the stimulus of light into electrical and chemical signals that can be interpreted by the brain to construct physics images. Students will learn about the parts of the eye and their functions. They will progress to learn about colours and how the eye interprets and sees colours. Students will use this knowledge to compare the workings of a human eye and a camera used for photographic images. Students will learn about the reflection of light and be introduced to concepts such as refraction. Refraction builds on composites 8.4, and 7.2 to explain refraction in terms of particles and density of materials.</p>

They will also understand how genetics can limit the capacity of a species and lead to extinction.	reaction, combustion, and reinforce the consequences this type of human activity has for the Earth this area is contextualising the materials encountered in 8.7.	
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