SCIENCE KS1, KS2, KS3 AND KS4

OUR AIMS

The intent of our primary science curriculum is to ensure that all pupils develop a sense of excitement and curiosity about the world around them. We want to equip them with the necessary science skills to help them understand the world and recognise the importance of science in the welfare of our future. The schemes of work in each year group have been written to ensure full coverage of the national curriculum and to promote a range of working scientifically skills, including questioning, researching and observing. We encourage our children to understand how science can be used to explain what is happening in each scientific investigation, predict how things will behave, and analyse causes. Scientific language is taught and then built upon as topics are revisited in different year groups and across key stages. It is our intent to encourage children to develop their scientific vocabulary, whilst learning to articulate scientific concepts. We aim to ensure that our children develop a secure understanding of each key block of knowledge and concepts in order to progress confidently to the next stage.

Year 1

Term	Unit of Study	Key Skills Learning
Autumn Term	*Animals including humans.* *Amazing Me!* *Seasonal changes.* *Wild weather*	Think carefully about what you were like as a baby and how your body has changed since then. Compare foot and hand sizes to make a class display. Consider how to investigate what we can hear in the playground. Investigate fruit and vegetables and plan a balanced picnic for guests. In this block, think about the weather, learn how to present data and make your own weather forecast to present to the class. Play shadow tag and create bar charts to record shadow length over time. Set up rain gauges to observe rainfall and bring all the learning together in a recorded weather forecast for the school website!
Spring Term	*Everyday Materials* *Brilliant Builders* *Plants* *Growing Things*	Explore and compare different materials and sort them into groups before writing songs based on their properties! Consider what it would be like if the tables were made of jelly or the chairs were chocolate! Then recreate the story of the three little pigs and predict what will happen to their houses. Explore outside and prepare tubs for planting potatoes. Record the growth of a bean and look at how it develops. Can you recreate the plant with craft materials? Can you label the parts of the plant? Look really closely at little cress plants and draw what you see. Then pop them into egg sandwiches for an egg and cress snack!
Summer Term	*Animals Including Humans* *Wild and wonderful creatures* *Animal Life Cycles*	Sort plastic animal toys into groups and learn about carnivores, herbivores and omnivores. Create show box dioramas for a toy animal and annotate it with researched information. Make a micro-safari for a toy car, with a recorded message for the pretend drivers!

	Food Chains	Talk about food chains and role play the interdependence between creatures in a chain, considering what part each plays in its survival. Explore the school grounds, looking for examples of food chains. Learn about water-based food chains and reconstruct them in tanks of water. Interpret the transfer of energy in a food chain through a dance, using masks and torches.

Year 2

Term	**Unit of Study**	**Key Skills Learning**
Autumn Term	Animals (including humans). People and their pets Seasonal changes Weather Art	Observe creatures in the school grounds; photograph them and make sketches. Collect woodlice and establish colonies in the classroom based on what children know about their habitats. Plan an investigation to test what sort of paper will be best for the job of mopping up a puppy's accident . Talk about and design a good pet and observe different pets in the classroom. Talk about the four seasons and make a seasons collage together. Go outside to experience the wind and make a windsock, windmill and bottle wind spinner in the classroom. Talk about the importance of the sun, design sun catchers to hang in the classroom and a sundial for the playground. Then explore shadows using torches and make shadow theatre characters to use with DIY light boxes and OHPs.
Spring Term	Everyday Materials Brilliant builders Plants	Rise to the challenge of fixing a torn umbrella, explore different materials and answer the questions: how can we know that this material will not let the rain through? How can we test it? Go on further to investigate the absorbency and waterproofing of materials. Investigate and sort materials according to where they came from. Learn all about those materials that come from plants. Create a large pollen sculptures out of clay, find flowers outside in the playground and

	Art and Nature	sketch them and then make a large model of the inside of a flower using junk modelling materials! Enjoy being outside by doing bark and leaf rubbings and then do a piece of playground art, using cloths, chalk and found materials.
Summer Term	Use of everyday materials Habitats – habitats and homes	Observe a block of ice and record the changes. Devise an investigation to melt the ice quickly or slowly. Then create puddles and measure how they change. Take up the challenge of investigating the absorbency of fabrics and explore changes in wax through batik art and crayon making. Make a playground allotment complete with edible plants and bird scaring sculptures. Weed and tend the allotment; visit a farm; and explore farming with small world play. In groups, design a bug hotel and build it.

Year 3

Term	**Unit of Study**	**Key Skills Learning**
Autumn Term	Electricity States of Matter	**An introduction to circuits and electricity in use.** Create your own amazing electric powered person or robot to impress your friends and family. Design a face with exciting electrical components such as a nose that buzzes when you press it or eyes that light up at the flick of a switch! You could even design some electrical accessories like a revolving bowtie or hat! The possibilities are endless so let your imagination run riot! First you will need to brush up on your electrical knowledge and expertise so let's get started! The Dartspring Science Museum is setting up an exciting new section for visitors which is all about States of Matter and they need your help. They need some good ideas to teach people the differences between solids, liquids and gases. Can you demonstrate what happens to matter when it is heated and cooled and how this happens in the local environment? The museum café wants to serve special themed foods and drinks and they need your help to develop this idea. Are you up to the challenge?

Spring Term	Sounds spectacular	A new rhythm band called "Sounds Spectacular" is being set up. The band members want to make great music using rhythms and tunes made from everyday items. Dave, the leader of the band needs a sound consultant to help him understand the scientific aspects involved, e.g. How will the audience hear the music? How can they change the volume or the pitch of the sounds? Dave hopes you will be able to help but it will mean setting up some investigations and getting to grips with some scientific research. Are you up to the challenge?
	Living things – classification	Our planet is full of beautiful plants and remarkable animals, it is an incredible world of living things, but what is special about something that is alive? Your task is to create an amazing interactive book that explains all about our incredible world of living things. Discover how living things are grouped according to their features. Create exciting pop-ups, spring-outs, lift-up flaps and turning wheels which show the wonderfully diverse groups of plants and animals on our planet.
Summer Term	Animals	Teignford hockey team have not won a match all season, and now is the time to turn things around if they want to win the league next year. Can you take on the challenge of coaching them to fitness? They need a whole pack of advice on diet, exercise and how to prevent injury, not to mention positive team spirit and self belief!
	Living things – positive environment	Our planet is full of beautiful plants and remarkable animals, it is an incredible world of living things, but what is special about something that is alive? Your task is to create an amazing interactive book that explains all about our incredible world of living things. Discover how living things are grouped according to their features. Create exciting pop-ups, spring-outs, lift-up flaps and turning wheels which show the wonderfully diverse groups of plants and animals on our planet.

Year 4

Term	Unit of Study	Key Skills Learning
Autumn Term	This planet rocks Shining the light	Some independent television programme makers want to make a documentary for children on rocks and fossils called This Planet Rocks! They would like children to present the show and be the rock experts. They have asked your class to help make some pilot programmes for them. Are you up to the challenge? You will need to brush up on your expertise on rocks, fossils and soils. The Rainbow Theatre have had a robbery. Some diamond earrings have been stolen during the dress rehearsal for the new play. There are 6 suspects to the crime and the police need your help to solve the mystery. There was a small audience for the rehearsal and they witnessed some strange events that led up to the robbery. Can you piece together the clues and solve the crime?
Spring Term	Habitat Helpers Greatly green growers	The plants and creatures in our amazing world are in danger because their habitats are changing for lots of different reasons. It is your job to help, but how? Governments are trying to make changes but they can only do so much. To make a difference, everyone needs to care enough to make changes. It is your job to persuade them by staging your own Habitat Helpers Fair which will teach people about the problems and what they can do to help. Are you up for the challenge? You will need to become experts on a number of important Green Issues affecting local and worldwide habitats. The members of the Greatly Green Horticultural Society (AKA The Greatly Green Growers) have been challenged to a growing competition by their rival town Croppingwell! The challenge is on to produce the heaviest marrow, the longest runner beans, the juiciest fruits and the biggest flowers! They need your help. Can you become their plant

		growing experts and find out through research and investigation, what plants need to grow as strong and healthy as possible?
Summer Term	The circle of life Electric personalities	Our amazing planet is teeming with life from the depths of the oceans to the highest mountains. But every living thing is dependent on other living things for its survival. Every animal needs to eat plants or other animals. Plants need rich soil to grow strong and healthy and soil is made rich for growing by the decomposing remains of plants and animals that were once alive. It is an endless circle of life. Your task is to share this amazing never ending story with an audience through dance, music and narration. Create your own amazing electric powered person or robot to impress your friends and family. Design a face with exciting electrical components such as a nose that buzzes when you press it or eyes that light up at the flick of a switch! You could even design some electrical accessories like a revolving bowtie or hat! The possibilities are endless so let your imagination run riot! First you will need to brush up on your electrical knowledge and expertise so let's get started!

Year 5

Term	**Unit of Study**	**Key Skills Learning**
Autumn Term	Living Things and Their Habitats The Human Species	You have been commissioned to create an inspirational and informative illustrated book on the theme of animal and plant life cycles. Develop your mastery of key art skills as you create eye catching illustrations that accurately tell the life cycle story of a range of nature's wonders. Along the way, hone your skills as a natural scientist and top off your work by 'meeting' David Attenborough, Jane Goodall and their natural scientist colleagues. Enter your final book into the 'Excellence in Scientific Illustration' awards. You have been approached to create an exhibition about the human species. Can you research and collate information on growth, development, puberty and old age, and present it in a sensitive and logical way that is suited to your audience? Create sculptures and sketches that not only reflect the complexity of the human body but also act as an accurate and informative presentation of the complex systems that help make us human. You have 6 weeks until the exhibition open.

Spring Term	Animals including humans	You have been approached to create an exhibition about the human species. Can you research and collate information on growth, development, puberty and old age, and present it in a sensitive and logical way that is suited to your audience? Create sculptures and sketches that not only reflect the complexity of the human body but also act as an accurate and informative presentation of the complex systems that help make us human. You have 6 weeks until the exhibition open.
	Light	A job opportunity has arisen at the National Theatre for a lighting technician and you have been asked to apply! You will need to put together a portfolio for the interview demonstrating that you have the skills and knowledge to put on a colourful and effects-driven show. You will need to make sure you have the technical know-how as well as a sound understanding of the science behind the behaviour of light.
Summer Term	Electricity	The National Sensory Art Association (NSAA) has asked you to create an electric art installation for a sensory garden exhibition. Take a lucky dip and find out your specific theme, while following the brief to use motors, switches, bulbs and buzzers to make your art a stand-out choice for display.
	Medical Manoeuvres	Use your knowledge from across the year to embrace a series of medical challenges from the Wellfordbury Hospital and see if you can help improve people's lives and the work of our health service. Explore possible approaches to help people recovering from or living with medical conditions, and investigate how understanding insect life cycles can help control certain diseases. Investigate and select the right materials for certain medical equipment as well as designing electrical and lighting systems to help with medical procedures. Test out your computing skills along the way and create your own blog to record your experiences.

Year 6

Term	**Unit of Study**	**Key Skills Learning**
. Autumn Term	Properties of Materials	The British Film Institute (BFI) directors need a new team of special effects technicians for a series of upcoming movies. You will need to explore a range of materials to create the desired special effects and compile a technician's guide.

	Earth and Space	Galileo Galilei needs your help at The Roman Inquisition: he needs to prove that the Earth moves round the sun; that the moon moves around the Earth; and that the seasons and day & night are all a consequence of these movements. He needs you to provide experimental evidence, not just current astrological thinking… and he is running out of time!
Spring Term	Forces	A new theme park is in the planning process and you have been selected to join the development team. Explore a range of forces and mechanisms, and see if you can incorporate them into a number of theme park rides.
	Living Things and Their Habitats	Explore the world of classification and release the next part of your classification code with each new challenge. As you become more expert you will move closer to cracking the code and discovering an interesting fact from the world of classification. Meet Linnaeus along the way; identify a range of living things right on your back door step; and explore creatures further afield as well. Your challenge culminates in designing your own new creatures that fit within the classification system.
Summer Term	Evolution and Inheritance	Take part in a series of challenges and explore which living things have survived in the game of life, evolving to keep one step ahead of the game. You will need to have your evolutionary wits about you and a keen eye for the survival of the fittest. Meet some evolutionary revolutionaries and use their approach to write your own Just So story.
	Sensational Science	Explore the more unexpected side to science and see how some things challenge our scientific expectations. Investigate some mind-blowing reactions, sensational space behaviour, fickle forces, crazy creature classifications, and some extraordinary evolution antics. Understand better how the scientific community develops theories and how some science debates will continue for a while to come.

Year 7/8

Term	Unit of Study	Key Skills Learning
Whole Year	The students will study topics in Biology, Chemistry and Physics and develop essential laboratory skills. We will follow the AQA specification. The ability to plan scientific investigations including risk assessment and test hypotheses, interpret scientific data help students to think and act like scientists forms a firm base for the development of further science study.	
Autumn Term	MATTER – Particle model'	• Know that there are three common states of matter: solid, liquid and gas. Recognise and describe the properties of solids, liquids and gases • Know the terms for changes of state: solid to liquid, liquid to gas, gas to liquid, liquid to solid and solid to gas • Know that all matter is made of very small particles (atoms, ions or molecules) and that these particles are arranged in different ways in solids, liquids and gases • Know that particles have energy and that they can gain or lose energy when being heated or cooled. Heating substances causes them to expand whilst cooling causes them to contract. This affects the density of the substance • Know that gas pressure is caused by collisions of particles with the walls of a container • Know that diffusion is the process by which particles in liquids or gases spread from a region many particles to one where there are fewer

	MATTER – 'Separating Mixtures'	• Know that a pure substance consists of only one type of element or compound and has a fixed melting and boiling point. Mixtures may be separated due to differences in their physical properties • Introduce terms solution, solvent and solute in the context of making a mixture of water and a soluble solid • Know that the method chosen to separate a mixture depends on which physical properties of the individual substances are different • Know that chromatography is used to separate mixtures of different coloured substances • Know that solubility is the maximum mass of solute that dissolves in a certain volume of solvent
	ORGANISMS – 'Movement'	• Know that the components of the human skeleton are responsible for protection of organs, support and movement • Know that the bone marrow creates new red and white blood cells • Draw a diagram of an antagonistic muscle joint labelling ligaments, tendons and cartilage and explain the functions of each of the parts • Know the different tissues that are found at a joint • Know how to label a diagram of joint to show the antagonistic muscles, ligaments, tendons and cartilage
	ORGANISMS – 'Cells'	• Know how to distinguish between unicellular and multicellular organisms • Know that multicellular organisms have different levels of organisation and that their cells are organised into tissues, organs and systems • Know how to use a light microscope to observe a slide of onion or cheek cells • Draw cheek and onion cells from microscope slides and label all visible features • Be able to identify and label the basic components of a plant and an animal cell. Know the function of the basic components of a plant and an animal cell • Name the key organ systems of the body and describe their main components. Know the function of the key organ systems of the body
		• Draw a circuit diagram to show how voltage can be measured in a circuit with several components • Describe how in a series circuit voltage is shared between each component and in a parallel circuit voltage is the same across all the components

	ELECTROMAGNETS – 'Voltage and Resistance'	• Use a table of voltage against current to find the ratio of voltage to current and therefore determine the resistance • Describe potential difference as the amount of energy shifted from the battery to the moving charge, or from the charge to circuit components, in volts • Use energy to explain the sizes of voltages in a circuit • Distinguish between electrical conductors and electrical insulators and give examples of their uses
	ELECTROMAGNETS – 'Current'	• Describe how in a series circuit current is the same in all of the components and in a parallel circuit current is split between the loops of the circuit • Describe current as the flow of electrical charge, with the unit amperes (A) • Draw diagrams to explain how objects may become charged when they are rubbed together • Relate the charge of an object to the gain or loss of electrons • Describe methods of reducing the risk of getting electrostatic shocks
Spring Term	FORCES – 'Speed'	• Describe how if the overall, resultant force on an object is non-zero, its motion changes and it slows down, speeds up or changes direction • Know how to use the formula speed = distance / time • Describe how the speed of an object varies when measured by observers who are not moving, or moving relative to the object • Describe how the motion of two objects moving at different speeds in the same direction would appear to the other
	FORCES – 'Gravity'	• Differentiate between mass and weight • Draw force diagrams to show the action of gravity in different situations. • Describe how gravity holds planets and moons in orbit around larger bodies. • Compare gravity to other forces
	ENERGY – 'Energy Costs'	• Define power as how quickly energy is transferred by a device • Know how to use the formula cost = power (kW) x time (hours) x price (per kWh)

	ENERGY 'Energy transfer' ECOSYSTEM – 'Interdependence' ECOSYSTEM – 'Plant Reproduction'	• Distinguish between renewable and non-renewable energy resources and give examples of each • Describe, in detail, energy transfers from a renewable or non-renewable resource to an electrical device in the home • Suggest actions a government or communities could take in response to rising energy demand, including reducing electricity use • Identify different types of energy store and give examples of each • Describe how the energy of an object depends on its speed, temperature, height or whether it is stretched or compressed • Relate observations of how sound travels to the properties of a longitudinal wave • Give examples of how energy is dissipated in a range of situations • Know definitions of the terms ecosystem, environment, population, producer and consumer and be able to give examples for each term • Know how to use information from a food web to explain the feeding relationships between organisms in an ecosystem • Explain the importance of insects to human food supplies • Know definitions of the terms predator, prey and interdependence • Know the parts of an insect pollinated flower and relate each structure to its function • Explain the process of pollination • Describe and give examples of different methods of seed dispersal • Explain how plants are adapted to disperse seeds using wind, water or animals
Summer Term	REACTIONS – 'Metals and Non-Metals'	• Know that metals are: shiny, good conductors of electricity and heat, malleable and ductile, and usually solid at room temperature. Non-metals are dull, poor conductors of electricity and heat, brittle and usually solid or gaseous at room temperature • Know that iron, nickel and cobalt are magnetic; mercury is a metal that is liquid at room temperature; bromine is a non-metal that is liquid at room temperature • Know that some metals react with acids to produce salts and hydrogen • Know that metals can be arranged as a reactivity series in order of how readily they react with other substances • Know that oxidation is a reaction a substance combines with oxygen and metals and non-metals react with oxygen to form oxides which are either bases or acids

		• Know that displacement is a reaction where a more reactive metal takes the place of a less reactive metal in a compound
	REACTIONS – 'Acids and Alkalis'	• Know that pH is a scale of acidity and alkalinity from 0 to 14 • Know that acids have a pH below 7, neutral solutions have a pH of 7, alkalis have a pH above 7; that hydrochloric, sulfuric and nitric acid are strong acids; and that acetic and citric acid are weak acids • Know that indicators are substances used to identify whether unknown solutions are acidic or alkaline • Know that mixing an acid and alkali produces a chemical reaction, neutralisation, forming a chemical called a salt and water • Know: that a base is a substance that neutralises an acid – those that dissolve in water are called alkalis
	GENES – 'Variation'	• Know the definition of the term species • Know that there is variation between individuals of the same species • Know the difference between continuous and discontinuous variation and give examples of each • Know the definition of the term adaptation • Explain, using examples, how variation helps a particular species in a changing environment
	GENES – 'Human Reproduction'	• Identify the key features of the male and female reproductive systems on a diagram and know the functions of these key features. • Explain the the importance of the menstrual cycle in human reproduction • Identify and explain key events in a 28 day menstrual cycle in a non-pregnant woman • Know definitions of the terms gestation, foetus, placenta, umbilical cord • Know how to label a diagram showing the main structures associated with the development of a foetus inside the uterus • Know the main stages of the development of a foetus from sex cells to birth • Know that contraception stops a woman getting pregnant and describe a range of different contraceptive devices
	WAVES – 'Sound'	• Define the terms amplitude, frequency and wavelength • Describe the amplitude and frequency of a wave from a diagram or oscilloscope picture • Define the term auditory range and explain why it means humans cannot hear certain sounds
		• Describe how when a light ray meets a different medium, some of it is absorbed and some reflected

	WAVES – 'Light'	• Define the terms transparent, translucent, opaque, absorption and scattering of light • Draw ray diagrams to show refraction occurring when light travels into a less dense medium and into a more dense medium • Draw a ray diagram to show reflection from a mirror, including the incident ray, reflected ray and normal line • Distinguish between convex lenses and concave lenses. Describe how lenses may be used to correct vision and relate this to the structure of the eye
	EARTH – 'Earth Structure'	• Know that the three rock layers inside earth are the crust, the mantle and the core • Know that sedimentary rock are formed from layers of sediment, and which can contain fossils • Know that igneous rocks are formed from cooled magma, with minerals arranged in crystals • Know that metamorphic rocks are formed from existing rocks exposed to heat and pressure over a long time • Know that sedimentary, igneous and metamorphic rocks can be inter converted through the rock cycle • Know that weathering is the wearing down of rock by physical, chemical or biological processes • Know that erosion is the movement of rock by water, ice or wind (transportation)
	EARTH – 'Universe'	• Know that the solar system consists of planets rotating on tilted axes while orbiting the sun, moons orbiting planets and sunlight spreading out and being reflected. • Know that an orbit is a path taken by a satellite, planet or star moving around a larger body. Earth completes one orbit of the sun every year • Know that stars are bodies which give out light, and which may have a solar system of planets • Know that our solar system is a tiny part of a galaxy, one of many billions in the Universe • Know that a galaxy is a collection of stars held together by gravity. Our galaxy is called the Milky Way • Know that an exoplanet is a planet that orbits a star outside our solar system

Term	Unit of Study	Key Skills Learning
Whole Year	The students will study topics in Biology, Chemistry and Physics and develop essential laboratory skills. We follow the AQA specification. The ability to plan scientific investigations including risk assessment and test hypotheses, interpret scientific data help students to think and act like scientists and forms a firm base for the development of further science study.	
Autumn Term	MATTER – 'Periodic Table'	• Know that the Periodic table shows all the elements arranged in rows and columns, and groups are columns of the periodic table and that Periods are rows • Know that metals are generally found on the left side of the table, non-metals on the right • Know that Group 0 contains unreactive gases called noble gases • Know that physical properties are features of a substance that can be observed without changing the substance itself • Know that Group 1 contains reactive metals called alkali metals • Know that chemical properties are features of the way a substance reacts with other substances • Know that Group 7 contains non-metals called halogens
	MATTER – 'Elements'	• Know that most substances are not pure elements, but compounds or mixtures containing atoms of different elements. • Know that elements are what all substances are made up of, and which contain only one type of atom • Know that a compound is a pure substance made up of two or more elements strongly joined together • Know that a chemical formula shows the elements present in a compound and their relative proportions • Know the symbols: hydrogen, oxygen, nitrogen, carbon, hydrogen, iron, zinc, copper, sulfur, aluminium, iodine, bromine, chlorine, sodium, potassium & magnesium • Know that atoms are the smallest particle of an element that can exist • Know that molecules are two or thousands of atoms joined together. Most non-metals exist either as small or giant molecules • Know that a polymer is a molecule made of thousands of smaller molecules in a repeating pattern. Plastics are man-made polymers, starch is a natural polymer

	ORGANISMS – 'Breathing'	• Know the names of the gases that are exchanged between the alveoli and the blood • Know how to label a diagram of the thorax to show the key parts of the human gas exchange system and know the function of these key parts • Explain why the rate of breathing is determined by the volume of oxygen the body needs • Explain how the ribs and diaphragm change the volume and pressure inside the thorax during inhalation and exhalation • Know the lung volume for an average person and how to measure lung capacity by displacing a volume of water with exhaled air • List and explain the factors that can affect the gas exchange system
	ORGANISMS – 'Digestion'	• Describe the key components of a balanced diet and use data to calculate the requirements of a healthy diet • Describe the key components of the human digestive system and know the function of each • Draw diagrams to show the locations of the key components of the digestive system • Describe how food is broken down by chemical and mechanical digestion • Describe and explain the importance of enzymes in the chemical digestion of food
	ELECTROMAGNETS – 'Electromagnets'	• Draw diagrams of the field lines around magnetic materials, showing the direction and strength of the magnetic fields • Give examples of magnetic materials and examples of practical uses of the magnetic properties of these materials
	ELECTROMAGNETS – 'Magnetism'	• Explain how an electromagnet generates a magnetic field • Describe the factors which effect the strength of the magnetic field generated by an electromagnet
Spring Term	FORCES –	• Define the term contact force and give examples of these type of forces • Draw a series of diagrams showing the size and direction of forces acting on a series of objects • Explain and give examples of the terms deformation, tension and compression

	'Contact Forces'	• Explain how different materials behave under tension or compression • Draw graphs to show linear and non-linear relationships • Define the terms friction and drag
	FORCES – 'Pressure'	• Explain how the effect of a force differs depending on the area over which the force applies • Explain, with examples how pressure acts in a fluid in all directions and increases with depth • Describe atmospheric pressure as the pressure caused by the weight of the air above a surface • Draw annotated diagrams to explain the behavior of fluids in a variety of different situations where the pressure is unequal
	REACTIONS – 'Chemical Energy'	• Know that an exothermic reaction is one in which energy is given out, usually as heat or light • Know that an endothermic reaction is one in which energy is taken in, usually as heat • Know that during a chemical reaction bonds are broken (requiring energy) and new bonds formed (releasing energy) • Know that a chemical bond is a force that holds atoms together in molecules • Know that catalysts are substances that speed up a chemical reactions but are unchanged at the end
	REACTIONS – 'Types of Reaction'	• Know that thermal decomposition is a reaction where a single reactant is broken down into simpler products by heating • Know that chemical changes can be described by a model where atoms and molecules in reactants rearrange to make the products and the total number of atoms is conserved
	ENERGY – 'Work'	• Know that combustion is a reaction with oxygen in which energy is transferred to the surroundings as heat and light • Explain the term work and give examples where work is done, including displacements and deformations

	ENERGY – 'Heating and Cooling	• Explain the factors that change the work required to move an object • Give examples of how levers, pulleys and wheels are all used to make work easier
		• Explain the difference between thermal energy and temperature • Explain what factors an object's thermal energy depends on
	ECOSYSTEM – 'Respiration'	• Know the definition of aerobic respiration as being the release of energy from glucose in the presence of oxygen • Know the reactants, products and word equation for respiration • Describe the difference between anaerobic respiration in animals, plants and microbes like yeast • Know how to write word equations for anaerobic respiration in animals, plants and microbes • Know that fermentation is the same as anaerobic respiration in yeast
	ECOSYSTEM – 'Photosynthesis'	• Describe the process of photosynthesis and how to write the word equation for photosythesis • Explain why only plants and algae that are green can carry out photosynthesis • Describe the role of plant roots and explain how plant roots are adapted to obtain named resources from the soil • Know the names of the tissues that transport materials to and from the plant roots • Explain how respiration and photosynthesis are related in plants • Explain the uses of the products of photosynthesis and the importance of these to other organisms • Explain how the rate of photosynthesis can be affected by changing the external conditions
Summer Term	GENES – 'Evolution'	• Know the definitions of the key terms natural selection, competition, evolution • Know the principles of Darwin's theory of natural selection • Explain that organisms have adaptations that help them survive in their environment • Explain the term extinction and give examples of organisms which are now extinct • Define the term biodiversity • Explain why biodiversity is important in ecosystems and why it is important to maintain biodiversity

	GENES – 'Inheritance'	• Explain the importance of DNA, genes and chromosomes in inheritance • Know how to draw a diagram to show the relationship between DNA, chromosomes and genes • Understand the terms genome, haploid, diploid, allele, homozygous, heterozygous, dominant, recessive • Define the terms mutation and carcinogen • Explain, with examples, the effect of changes in DNA on an organism and its future offspring
	WAVES – 'Wave effects'	• Know how when a wave travels through a substance, particles move to and fro, transferring energy in the direction of movement of the wave • Explain the term pressure wave and give examples of pressure waves • Describe the functions of microphones and loudspeakers
	WAVES – 'Wave properties'	• Explain, with examples including light and sound, the differences between longitudinal and transverse waves • Describe how a physical model of a transverse wave shows how the waves moves from place to place, while the material it travels through does not • Explain, with examples, the meaning of transmission of a wave
	EARTH – 'Climate'	• Know that carbon is recycled through natural processes in the atmosphere, ecosystems, oceans and the earth's crust as well as human activities • Know that the earth's atmosphere contains around 78% nitrogen, 21% oxygen, <1% carbon dioxide, plus small amounts of other gases

	EARTH – 'Earth Resources'	• Know that fossil fuels are the remains of dead organisms that are burned as fuels, releasing carbon dioxide • Know that a carbon sink is an area of vegetation, the ocean or the soil, which absorbs and stores carbon • Know that greenhouse gases reduce the energy lost from the earth through radiation and so the temperature has been rising with the concentration of gases • Know that the greenhouse effect is when energy from the sun is transferred to the thermal energy store of gases in earth's atmosphere • Know that there is only a certain quantity of any resource on earth, so the faster it is extracted, the sooner it will run out. Recycling reduces the need to extract resources • Know that most metals are found combined with other elements, as a compound, in ores. The more reactive a metal, the more difficult it is to separate it from its compound. Carbon displaces less reactive metals, while electrolysis is needed for more reactive metals

GCSE YEAR A

Term	**Unit of Study**	**Key Skills Learning**

Over View of Year.	AQA GCSE Science Synergy Students following this programme will: • Develop scientific knowledge and conceptual understanding through the specific disciplines of Biology, Chemistry and Physics • Develop understanding of the nature, processes and methods of science, through different types of scientific enquiries that help them to answer scientific questions about the world around them • Develop and learn to apply observational, practical, modelling, enquiry and problem-solving skills in the laboratory, in the field and in other learning environments • Develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively. Students are assessed through examination and the completion of the eight core practical investigations.	
Autumn Term	States of Matter	In this topic, students have learnt about the particle arrangements in solids, liquids, and gases and how these relate to their properties. Students should be able to name the changes of state and explain the changes that occur in terms of energy changes and particle behaviour. Students will have learnt to use a variety of calculations and should be able to calculate density and measure specific heat capacity and latent heat of vaporisation. Students should be able to manipulate the equations for density, specific heat capacity, latent heat of fusion, and latent heat of vaporisation. Students should have investigated the relationship between temperature and pressure in a gas. Students should be able to state that increasing temperature increases the pressure of a gas in a sealed container. Students should also be able to describe the differences between pure and impure substances and to use boiling and melting point to test for purity.
	The Periodic Table	In this topic, students have developed their understanding of atoms as fundamental chemical building blocks. They have outlined the development of the periodic table from its experimental origins to an explanation of the pattern shown within it. They have learnt how to interpret chemical formulae and have extended their Key Stage 3 knowledge of the law of conservation of mass, leading them to balance chemical equations. It is important that students understand that, when balancing an equation, the formula of the substance must not change. Students will have examined the properties of elements in Group 1 (the alkali metals), describing their physical properties; their reactions with water and chlorine gas; and the patterns that occur. Similarly, students will

	Atomic Structure	have studied the elements in Group 7 (the halogens) and the patterns in behaviour found in that group. In both cases, students will have used chemical symbol equations to describe reactions. Finally, students will have learnt about electron configurations as the underlying reason for patterns of behaviour within groups. Students should be able to explain increases and decreases in reactivity in terms of the size of atoms and the distance of most other electrons from the atomic nucleus. In this chapter, students have learnt about the structure of an atom. Students should be able to name the sub-atomic particles and draw the structure of an atom. Students have learnt about how ideas about the structure of the atom have changed, resulting in the nuclear model we use today. Students will have learnt to use the periodic table to find the atomic number and mass number. Students should be able to use the periodic table to deduce the number of sub-atomic particles in atoms, ions, and isotopes. Students should able to state the number of electrons in each energy level of an atom. Students have learnt to write the standard electronic notations and to draw the electronic structure of some elements.
	Radiation and Risk	In this chapter, students have learnt about the different types of radioactive decay and their properties. Students should be able to describe what happens when atoms lose energy, and how radioactivity is measured. Students should be able to express some types of radioactive decay in the form of a nuclear equation. Students will have practised plotting graphs from given data and should be able to use these to calculate half-life. Students will have explored the hazards associated with radiation, including cancer. Students should be able to describe the different causes of cancer. Students will have explored and analysed the benefits and risks of some of the treatments available for cancer.
	Lifestyle and Health	In this topic, students learnt about how lifestyle factors can affect health. Students should be able to describe the difference between communicable and non-communicable diseases, and to describe risk factors for and the effects of some non-communicable diseases. Students will have learnt about the different treatments available for cardiovascular disease, and should be able to discuss the risks and benefits of these treatments. Students will have learnt about the need for homeostasis in the body. Students should be able to describe the control of blood sugar levels in the body. They should also be able compare the causes, effects, and treatments for Type 1 and Type 2 diabetes. Students will also have covered the changes that happen in the body during puberty, and should be able to relate these to changes in particular hormones. Students should be able to explain the changes that occur during the menstrual cycle. Students should be able to describe the advantages and disadvantages of different types of contraceptives. Higher-Tier students should be able to describe different infertility treatments.

	Chemical Quantities	In this topic, students have learnt how chemical symbols are used to represent the different elements during reactions, and that each element has a different atomic number and an associated mass number. Students should have discussed the difference between atoms, elements, and compounds, including the use of formulae for different compounds such as H_2O. All students will have spent some time developing their skills in writing chemical equations for a range of different reactions using the concept of reactants and products. This will have included the idea of balancing equations (according to conservation rules) and the use of state symbols. Students will be discussed relative atomic mass and relative formula mass for compounds. Higher-Tier students will have gone further and described amount of substances in terms of moles, converting between number of moles and mass and vice versa. Higher-Tier students will also have applied these concepts to a range of calculations for chemical equations, including looking at how the masses of reactions and products can be used to determine balanced chemical equations for reactions. Students will then have applied their understanding of relative atomic mass, relative formula mass, and moles to concentrations. Students should be able to calculate the concentration of a solution from the masses of the solution and solute.
	Forces and Energy Changes	In this chapter, students have examined physical quantities and have discussed the nature and representation of vectors and scalars using examples involving distances, movement, and forces. They have discussed the action of individual forces on objects and the action of multiple forces through the calculation of resultant force. Newton's First Law of motion has been used to discuss the behaviour of an object when balanced or unbalanced forces act on it. Higher-Tier students will have used free body diagrams to describe systems and have applied the parallelogram of forces method to determine the resultant of pairs of forces using scale diagrams. Higher-Tier students have also resolved forces into two perpendicular components. All students will have discussed energy change through the concept of doing work on a system or object using a force that acts through a distance. Students will have compared the changes in energy stores through heating processes from frictional forces and the changes to gravitational stores through lifting and falling. Students will then have examined the work done in stretching a material, causing an extension. Students should be able to apply the concepts of elastic behaviour and linear stretching according to Hooke's law to the use of the spring constant in a range of calculations.
Spring Term		In this chapter, students have learnt how to use a microscope to view specimens safely. Students should be able to calculate the magnification used. Students have learnt about the different structures in animal, plant, and prokaryotic cells, and their functions.

	Cells in Animals and Plants	Students will have seen examples of diffusion, osmosis, and active transport. Students should be able to describe and explain how movement occurs by these different methods of transport and to interpret diagrams showing this. Students will have learnt the differences between mitosis and meiosis, and should be able to describe both processes. Students should be able to relate this to cell division and differentiation.
	Lifestyle and Health	In this chapter, students learnt about how lifestyle factors can affect health. Students should be able to describe the difference between communicable and non-communicable diseases, and to describe risk factors for and the effects of some non-communicable diseases. Students will have learnt about the different treatments available for cardiovascular disease, and should be able to discuss the risks and benefits of these treatments. Students will have learnt about the need for homeostasis in the body. Students should be able to describe the control of blood sugar levels in the body. They should also be able compare the causes, effects, and treatments for Type 1 and Type 2 diabetes. Students will also have covered the changes that happen in the body during puberty, and should be able to relate these to changes in particular hormones. Students should be able to explain the changes that occur during the menstrual cycle. Students should be able to describe the advantages and disadvantages of different types of contraceptives. Higher-Tier students should be able to describe different infertility treatments.
	Waves	In this chapter, students have learnt about the properties of waves. Students should be able to identify the amplitude, wavelength, peak, and trough of a wave. Students will have learnt the differences between transverse and longitudinal waves. Students will have learnt to use the wave equation and should be able to apply it in a variety of situations. Students will have learnt about the different parts of the electromagnetic spectrum and their uses, including the differences in their frequency, energy, and effect on matter. Students should be able to identify the different parts of the electromagnetic spectrum. Higher-Tier students will have learnt about refraction and should be able to describe and explain refraction as a wave moves from one medium to another.
		In this topic, students have learnt about the different types of bonding in substances and how this affects the physical properties and behaviours of compounds. They started by looking at the formation of ions, describing this

	Structure and Bonding	in terms of the loss or gain of electrons from the outer shell of atoms, resulting in charged particles. This led to the concept of ionic bonding, which was described as atoms being together by the attractive forces between ions. This was linked to the ions formed by different elements based on their group in the periodic table. Students will have discussed the formation of giant ionic structures due to the interaction between charged particles, leading to crystal structures such as sodium chloride. Students will have learnt about the conductive properties of molten ionic compounds or ionic solutions. Covalent bonding was described in terms of 'sharing' of electrons to form full outer energy levels. This leads to the formation of smaller molecules such as the gases O2, H2, and so on. Students will have explored the properties of giant covalent structures, such as diamond. Students should be able to use a range of models to describe bonding, including dot and cross diagrams and ball and stick models. Students should understand the relationship between the atoms in a structure. Finally, students will have explored the bonding in giant metallic structures, along with their properties (e.g., electrical conductivity). Students should be able to describe the formation of alloys to change the physical properties of metals.
	Magnetism and Electromagnetism	In this unit, students have explored the interactions between magnets and magnetic materials using the concepts of magnetic poles and magnetic fields. They should have described magnetic fields in terms of field lines or lines of force, and they should be able to explain that the strength of the field is linked to the number of field lines drawn. Students will have explored the shape of fields using iron filings and plotting compasses. They will have described how magnetism can be induced in magnetic materials and will have discussed the shape of the Earth's magnetic field. Students will have moved on to discuss the magnetic effect of a current-carrying wire and investigate the factors that affect the strength and direction of this field, that is, the size and direction of the current. They will have expanded on this concept to include the field produced inside and outside a solenoid, which they should have compared to that of a bar magnet. Students will have learnt about the uses of electromagnets, including solenoids. Higher-Tier students will have explored the motor effect and its use to produce forces, including the factors that affect the size and direction of the force. They will have used Fleming's left-hand rule to determine the relationship between current direction and force direction. Students should be able to give a more formal definition of the strength of magnetic fields using the concept of magnetic flux density. Finally, students will have learnt about the application of the motor rule though practical electric motors, including the construction of a motor and its connection to a d.c. supply through a split-ring commutator.

	Forces and Motion	In this unit, students have analysed the motion of objects in terms of displacement, speed, and acceleration. They should have analysed distance–time graphs to see how the motion of an object changes. They should be able to use the speed equation to determine the average speed of objects. Students will have used velocity–time graphs to further analyse motion and discuss the acceleration of an object, applying the relevant equations. Further analysis of velocity–time graphs will have allowed students to determine distance travelled and acceleration using the gradient of sections of the graphs, including the use of a tangent to determine instantaneous acceleration. Higher Tier students will have described circular motion in terms of acceleration. Students will have explored resultant force as the cause of acceleration, leading to a discussion of Newton's Second Law and the application of the equation F = m a. Higher Tier students will have briefly touched on the concepts of inertia and inertial mass. All students will have learnt about the action of forces and the acceleration of objects as they fall in a gravitational field, including falling through fluids such as air or water. HigherTier students will have analysed the collisions of objects through the concept of momentum, whilst all students will have analysed motion using the concepts of kinetic energy and energy transfer. Students should be able to discuss forces and acceleration in the context of car braking.
Summer Term	Systems in the Human Body Waves	In this chapter, students learnt about many systems in the human body. Students should be able to outline the processes that occur in the gas exchange system, circulatory system, digestive system, nervous system, and endocrine system. Students will have learnt the differences between aerobic and anaerobic respiration and the importance of gas exchange in these processes. Students will have learnt about the circulatory system and should be able to identify the different blood vessels and the major components of the blood, and to relate their structure to their function. Students will have learnt about the different components of a balanced diet and how to test for these substances experimentally. Students should also know where these components are broken down and absorbed in the human digestive system. Students will have learnt the major parts of the nervous and endocrine systems, and how nervous and hormonal actions are coordinated. Higher-Tier students should also have learnt about the importance of negative feedback systems in the body.

	Plants and Photosynthesis	In this chapter, students have learnt about the properties of waves. Students should be able to identify the amplitude, wavelength, peak, and trough of a wave. Students will have learnt the differences between transverse and longitudinal waves. Students will have learnt to use the wave equation and should be able to apply it in a variety of situations. Students will have learnt about the different parts of the electromagnetic spectrum and their uses, including the differences in their frequency, energy, and effect on matter. Students should be able to identify the different parts of the electromagnetic spectrum. Higher-Tier students will have learnt about refraction and should be able to describe and explain refraction as a wave moves from one medium to another.
	Preventing, Treating and Curing Diseases	In this chapter, students learnt about the specialised tissues and organs in a plant. Students should be able to outline the adaptation of cells and tissues in a plant and relate these to their function. Students will have observed these specialised cells and tissues under a light microscope and should be able to identify them. Students will have learnt about the requirements for photosynthesis. Students should be able to describe and explain the effects of a variety of factors on photosynthesis. They should also be able to describe transpiration and explain the effect of a variety of factors on transpiration. Students will also have covered differentiation in plants and plant diseases. Students should have used chromatography to separate pigments or dyes and should be able to analyse their results, including calculating the R_f value.
	Forces and Motion	In this chapter, students have learnt about how disease affects the body. Students should be able to describe how diseases are caused by pathogens, the ways in which they can be spread, and methods to prevent the spread of disease. Students will have learnt about natural and artificial ways to deal with disease. Students should be able to describe the body's different defence mechanisms and to explain how vaccination works. They will also have explored uses of other medicinal drugs, including antibiotics and painkillers.

		Students will have learnt about the way in which new drugs are developed. Students should be able to describe what a double-blind trial is. Students should have investigated some of the more recent advancements in the treatment of disease. Students should be able to describe the role of genetic modification and stem cells in modern medicine, and to discuss the ethical issues surrounding these techniques.
	Electricity	In this chapter, students have analysed the motion of objects in terms of displacement, speed, and acceleration. They should have analysed distance-time graphs to see how the motion of an object changes. They should be able to use the speed equation to determine the average speed of objects. Students will have used velocity–time graphs to further analyse motion and discuss the acceleration of an object, applying the relevant equations. Further analysis of velocity–time graphs will have allowed students to determine distance travelled and acceleration using the gradient of sections of the graphs, including the use of a tangent to determine instantaneous acceleration. Higher Tier students will have described circular motion in terms of acceleration. Students will have explored resultant force as the cause of acceleration, leading to a discussion of Newton's Second Law and the application of the equation F = m a. Higher Tier students will have briefly touched on the concepts of inertia and inertial mass. All students will have learnt about the action of forces and the acceleration of objects as they fall in a gravitational field, including falling through fluids such as air or water. HigherTier students will have analysed the collisions of objects through the concept of momentum, whilst all students will have analysed motion using the concepts of kinetic energy and energy transfer. Students should be able to discuss forces and acceleration in the context of car braking.
	Acids and Alkalis	In this topic, students have learnt about the construction of simple electric circuits, beginning with the idea of a complete circuit with an electric current in it. Students will have described current as the flow of electrical charge through conductors, and should be able to calculate the size of a current using the appropriate equation. Students will have explored the cause of a current in terms of potential difference and the effect of resistance on the size of the current, linking these properties using equations and by analysing patterns of behaviour through current-potential difference graphs. Students should be able to analyse the behaviour of a range of components and explain how some of these, such as thermistors, can be used to sense the environment based on changes in their resistance. Students will have analysed the behaviour of series and parallel circuits before discussing the differences between alternating and direct currents. This will have led to an analysis of mains electricity supplies, their varying potential difference, and how the National Grid is used to deliver electricity supplies efficiently using transformers. Students

		will have learnt about the construction of mains circuits in houses, including the choice of materials used to make various components. Finally, students will have analysed the use of electrical appliances in terms of power delivered to the devices and their efficiency. Students should be able to use the related equations. Students will have used the current in circuits as a basis for selection of appropriate fuses and to describe the electrical heating effect. Students should be familiar with the idea of energy transfer within a circuit and should be able to calculate the energy transfers produced by moving charges. In this unit, students have learnt about the formation of salts when a metal reacts with an acid, including a range of different acids and metals. Working from the general equation, students will have formed equations for all of these reactions, with Higher-Tier students also explaining the reactions in more depth using ionic equations. Students will have explored (both theoretically and practically) the formation of salts from insoluble bases, including the formation of copper(II) sulphate from copper(II) oxide. Students should be able to describe these reactions as examples of neutralisation. Students will have studied further examples of neutralisation, including the reactions of acids and alkalis and acids and carbonates, and the production of a metal from a carbonate. Students will have tested some exothermic and endothermic reactions, discussing the energy transfer that takes place in each situation. They will have examined the temperature change during a reaction to determine whether the reaction is exothermic or endothermic and to measure the extent of the energy change. Higher-Tier students will have discussed calculation of the energy change in terms of joules per mole. Students should be able to use the pH scale as a measure of acidity or alkalinity, and to describe how to produce a pH curve during titration. In addition, Higher-Tier students should be able to explain how pH relates to H^+ (aq) ion concentration, and the difference between strong and weak acids.

GCSE YEAR B

Term	**Unit of Study**	**Key Skills Learning**
Whole Year	AQA GCSE Science Synergy Students following this programme will: • Develop scientific knowledge and conceptual understanding through the specific disciplines of Biology, Chemistry and Physics • Develop understanding of the nature, processes and methods of science, through different types of scientific enquiries that help them to answer scientific questions about the world around them • Develop and learn to apply observational, practical, modelling, enquiry and problem-solving skills in the laboratory, in the field and in other learning environments • Develop their ability to evaluate claims based on science through critical analysis of the methodology, evidence and conclusions, both qualitatively and quantitatively. Students are assessed through examination and the completion of the eight core practical investigations.	
Autumn Term	The Earth's Atmosphere	In this unit, students have learnt about the changing atmosphere of the Earth and how human activity is affecting air and water quality. Students should be able to explain why the atmosphere on Earth has changed. Students will have learnt about the greenhouse effect, its causes, and its effects on climate and the environment. Students will have learnt how human activity introduces atmospheric pollutants. Students should be able to describe the formation of acid rain and describe several atmospheric pollutants and their effect on human health. Students will also have covered changes in the carbon cycle and the water cycle, and should be able to explain the processes involved in these cycles. Students should also be able to discuss the impact that human activity has on the processes within these cycles, including the treatment of water and sewage.

	Ecosystems and Biodiversity	In this topic, students have learnt about the factors that affect communities and the resources for which organisms compete. Students should be able to define key terms including ecosystem, community, predator, prey, consumer, and producer. Students will have learnt how organisms live in interdependence, and should be able to explain the reasons for population size changes in a predator–prey relationship. Students will have learnt how to conduct a field investigation to estimate population sizes. Students will have explored the use of quadrats and transects. Students should be able to plan and carry out an investigation, and to analyse the results. Students will also have covered the ways in which human activities affect biodiversity. They will have learnt about the effects of eutrophication and bioaccumulation. Students should be able to describe the effect that increasing human population has on biodiversity, including the effects of deforestation and pollution, as well as actions by humans that have a positive effect on biodiversity.
	Preventing, Treating and Curing Diseases (continued)	In this topic, students have learnt about how disease affects the body. Students should be able to describe how diseases are caused by pathogens, the ways in which they can be spread, and methods to prevent the spread of disease. Students will have learnt about natural and artificial ways to deal with disease. Students should be able to describe the body's different defence mechanisms and to explain how vaccination works. They will also have explored uses of other medicinal drugs, including antibiotics and painkillers. Students will have learnt about the way in which new drugs are developed. Students should be able to describe what a double-blind trial is. Students should have investigated some of the more recent advancements in the treatment of disease. Students should be able to describe the role of genetic modification and stem cells in modern medicine, and to discuss the ethical issues surrounding these techniques.
	Atoms into Ions and Ions into Atoms	In this topic, students have examined the reactivity series. Beginning with the concept of extracting metals from ores, they will have moved on to discuss the reactions of metals with water and dilute acids. Students should be able to use the reactivity series to explain simple displacement reactions, with Higher-Tier students describing these in terms of ionic equations and oxidation and reduction. Students will have learnt about electrolysis in terms of ion movement within a fluid (molten substance or ionic solution). Students will have used the concept of ion movement to explain how substances may be separated, testing the effect experimentally. Students should be able to describe the processes happening at the anode and the cathode in terms of the gain or loss of electrons to form elements. Higher-Tier students should be able to

	The Rate and Extent of Chemical Change	form half equations to show the processes in more depth. Students will have investigated the electrolysis of some aqueous solutions, such as sodium chloride. Students will have learnt how different gases can be detected using simple tests. They should be able to form word and symbol equations for each of these. In this unit, students have investigated a range of factors that affect the rate of a chemical reaction. Starting with the definition of rate, students will have monitored some simple reactions and analysed graphs showing changes in mass (as a gas escaped) or volume of gas produced, linking these to how fast the reaction was taking place. Students should be able to describe reactions in terms of successful collisions between particles, and use this model to describe why reaction rates increase as the surface area of a solid increases. Continuing with the particle model, students will have learnt about the effect of temperature on the number of collisions and the analysis of activation energy, backing this work up experimentally. Students will have outlined the effect of pressure and concentration on the rate of a reaction and will have investigated the reaction between marble chips and different concentrations of hydrochloric acid. Higher-Tier students will have analysed the results of this type of experiment in more detail, calculating the rate of reaction at different points during the experiment from graphs. Students will have discussed the concept of activation energy, with Higher-Tier students calculating changes in energy for reactions. Students will have described the effect of catalysts and enzymes on reactions using the lock and key theory, and should be able to explain how the effectiveness of enzymes is influenced by temperature and pH. Finally, students will have learnt about reversible reactions and dynamic equilibrium, with Higher-Tier students discussing the effect of temperature and pressure on equilibrium conditions in more depth.
Spring Term	Inheritance	In this topic, students have learnt about how variation is caused by both genes and the environment. Students should be able to model how sex and characteristics that display monohybrid inheritance are inherited using genetic diagrams. Students will have learnt how to use these diagrams to predict probability of inheritance of characteristics, and should be able to describe the genotypes and phenotypes of parents and offspring using the correct genetic terminology. Students will have learnt about the process of evolution and should be able to describe the mechanism of natural selection. Students will also have learnt about the different evidence that we have for evolution. Students will have covered how classification systems have changed because of our knowledge of DNA.

		Students will also have covered techniques that humans use to manipulate inherited characteristics, namely selective breeding and genetic engineering. They should be able to discuss the benefits and the issues surrounding these techniques.
	Variation and Evolution	In this unit, students have learnt about how variation is caused by both genes and the environment. Students should be able to model how sex and characteristics that display monohybrid inheritance are inherited using genetic diagrams. Students will have learnt how to use these diagrams to predict probability of inheritance of characteristics, and should be able to describe the genotypes and phenotypes of parents and offspring using the correct genetic terminology. Students will have learnt about the process of evolution and should be able to describe the mechanism of natural selection. Students will also have learnt about the different evidence that we have for evolution. Students will have covered how classification systems have changed because of our knowledge of DNA. Students will also have covered techniques that humans use to manipulate inherited characteristics, namely selective breeding and genetic engineering. They should be able to discuss the benefits and the issues surrounding these techniques.
	Carbon Chemistry	In this topic, students started by describing the structure, properties, and uses of large carbon molecules, fullerenes, and graphene. Students have learnt how crude oil can be used to produce a range of hydrocarbons through fractional distillation. Students will have described the structure of the first four alkanes (methane, ethane, propane, butane) before identifying a general formula. Students will have considered the complete and incomplete combustion of hydrocarbons, with Higher-Tier students going on to calculate the masses involved. Finally, students will have learnt about the process of cracking. This involves the breaking of long-chain molecules to produce smaller molecules. Students will have discussed the structure of the alkenes produced in this process, and the double bond they contain. Students should be familiar with the formation of simple polymers.

	Resources of Materials and Energy	In this unit, students have examined the extraction of metals from their ores. They will have looked at the reduction of metal oxides by carbon and then by hydrogen, based on the reactivity series. Students should be able to outline the extraction of aluminium from its oxide through electrolysis, with Higher-Tier students examining the ionic equations for reactions at the anode and cathode. Higher-Tier students will have explored the extraction of copper from malachite and its subsequent purification through electrolysis. Students will have learnt about the UK's energy demands and possible ways to meet this demand, covering biofuels, nuclear power, wind power, wave power, tidal power, and solar power. Students should be able to discuss these energy sources in terms of feasibility, economic cost, and environmental impact. Students will have considered how systems can be analysed in terms of energy, allowing predictions about behaviour to be made. This included the concept of conservation of energy and the processes of doing work by lifting or heating. Students will have learnt about the processes of dissipation of energy through heating, and about ways to reduce these energy 'losses' to the environment. Students should be able to calculate the efficiency of a range of energy transfer processes. Finally, students will have looked at the life cycle of materials in terms of environmental impact and the potential for materials to be recycled or reused as appropriate.
Summer Term	YEAR 10's to cover YEAR A Summer Term topics YEAR 11's Revision and Exams	Year 10 – see Summer term of Year A for topic description. Year 11 – Revision and Exams

ENRICHMENT OPPORTUNITIES

HOW TO SUPPORT YOUR CHILD'S LEARNING

Talk to your child daily, modal positive conversations, relationships and listening skills. Ask your child: have you had a nice day? Has anything interesting happened today? What have you learnt today? What were your achievements from today? Have we got any homework to do today? Has anything about today worried you? Who did you play with today? What games did you play? Were they fun? What topics are you covering in science? Did you learn anything new or surprising?
Watching documentaries together.

KS3 Revision–

BBC Bitesize has useful information and quizzes on all the topics covered in KS3 science.

KS4 Revision–

Subject: Combined Science - Synergy

Exam board: AQA

Assessment summary: 4 1h45m exams. Paper 1 and Paper 2 test Strand One and Papers 3 and 4 test strand two.
Past Papers and Mark Schemes: specimen material is available on the AQA website.
http://www.aqa.org.uk/subjects/science/gcse/combined-science-synergy-8465/assessmentresources

Useful Revision Websites: There is lots of useful information available on the BBC website to support revision and past students have found sites such as https://www.my-gcsescience.com/ ;

http://www.darvill.clara.net/index.htm ; and http://www.docbrown.info/index.htm very useful. Some of these may have subscription fees associated with them.

Revision apps:

There are many apps available to support your learning. It is important to check that they cover the new 9-1 GCSEs before using them.

Recommended revision guides: The school can provide students with revision guides from CGP at cost. Ask your science teacher. It is important to note that the revision guides often come with a code to download a digital copy of the guide.

Other useful information: Always remember that your teacher is a valuable resource and that they are always willing to support you in achieving your best possible result.