Keyham Lodge School
Science
Department

Working together to inspire and achieve

Science Curriculum

Course Options for Key Stage 4

Contents

1. Introduction

Intent of the curriculum:

The science curriculum has been developed with the intention of ensuring all students develop a deep understanding of the scientific world in which they live.

All students studying the curriculum will be taught what they need to understand and improve an increasingly scientific world.

Prior Learning:

All students in year 7-9 study the school's bespoke thematic curriculum. This provides them with a good grounding in science and allows them the opportunity to experience some aspects of each option course available to them at key stage 4.

Key stage 4 course	Project Link
Trilogy (combined science double GCSE)	All projects
Biology (single science GCSE)	Cluedo Space invaders Football manager Rollercoaster tycoon Pandemic
Sports Science Camb. Nat.	Football manager
Horse Care BTEC	Rollercoaster tycoon
Health and Social Care Camb. Nat.	Pandemic
Animal Care ASDAN	Space invaders Rollercoaster tycoon
Entry Level Certificate	All projects

Future Destinations:

Key stage 4 course	Future Pathway
Trilogy (combined science double GCSE)	Further study of all three sciences possible at A level- provides two GCSE grades
Biology (single science GCSE)	Further study of Biology at A level- provides one GCSE grade
Sports Science Camb. Nat.	Further study of sports science at higher levels, Biology, PE, Psychology and Combined Science
Entry Level Certificate	Further study of combined science or individual sciences at GCSE

2. Entry Level Certificate

Long Term Plan:

KS4 Course: Entry Level Certificate Science
Lead Teacher: Adam
Provision type: Onsite and Offsite via IRT
Aims and Learning Outcomes: • develop their interest in, and enthusiasm for, science • develop a critical approach to scientific evidence and methods • acquire and apply social skills, knowledge and understanding of working scientifically and its essential role • acquire scientific skills, knowledge and understanding necessary for progression to further learning • apply literacy, numeracy and information technology skills
Assessment Objectives: • AO1: Show knowledge and understanding of science, and how it works, and apply it where appropriate. Students should be able to: • recall scientific facts • apply scientific ideas. • AO2: Demonstrate the ability to design an investigation, take measurements, present data and identify patterns and relationships. Students should be able to: • plan a simple investigation, identifying the techniques or equipment needed and the method to be followed • make a simple prediction about the outcome of the investigation • use equipment and materials safely to take simple measurements or observations that are meaningful and valid • record the results in an appropriate way • display the data using an appropriate method • state what has been found out during the investigation (drawing a conclusion) and describe simple relationships in the data • simply evaluate the investigation for its success in justifying the initial prediction.

Timing	Unit/Topic	Where it has been seen before	Life Link/Work Experience	Cultural Capital/ CORE
14 Hrs	Unit 1: The human body: The human body is composed of structures called organs, which are organised into organ systems that carry out all of the key processes of life. These systems all require	Key stage 3, year 7 health topic, cells and organisation, nutrition and digestion. Skeletal and	Anatomical aspects of the topic relatable to some of the sporty students in the class,	Oracy development in discussions about taking drugs

1 Hrs 3 hrs	energy, which is contained in food and released in the cell by respiration. The organ systems are responsible for delivering food and oxygen to the cells and taking away waste. All these key processes, including reproduction, are coordinated by the nervous system and a hormone system. A healthy body can be maintained by a balanced diet, exercise and a healthy lifestyle. Health can be damaged by microbes, which can cause infectious diseases. The body can defend itself against most diseases but will sometimes need drugs in order to alleviate the symptoms and speed recovery ESA TDA	muscular system	who also do sports pathways. Discussions about fitness and sporting injuries etc. Others in the class are smokers or know smokers, and learning about health within this context is relatable. Potential work experience: Hospital visit	and alcohol. Character building learning about healthy lifestyles.
14 hrs 1 hrs 3 hrs	Unit 2: Environment, evolution, and inheritance. Life on Earth is dependent on photosynthesis to fix carbon dioxide and produce the organic molecules used as the fuels for respiration and life processes. Living organisms interact with one another and their environment in many different ways. Human behaviours may have beneficial or detrimental effects on natural populations and the environment. The chemicals in the environment are continually cycling through the natural world. Life on Earth has evolved over time by natural selection, which accounts for biodiversity and	Key stage 3 genetics and ecology topics. Cells and organisation, photosynthesis	Linking evolution and inheritance to the emergence of covid19 places learning in a relatable context. Environmental understanding is developed around what students hear about in the news such as	Character develops as students learn about being a responsible citizen in terms of environmental impact.

	how organisms are related. The characteristics of living things depend on both their environment and their genome. Humans can now use genetic engineering to modify organisms ESA TDA		global warming and pollution. Natural history museum?	
14 hrs 3 hrs 1 hrs	3. Elements, mixtures and compounds. Matter is composed of tiny particles called atoms and there are about 100 naturally occurring types of atoms called elements. Elements are shown in the periodic table and are either metals or non-metals. Atoms are the building blocks for all substances. When two or more elements combine chemically a compound is produced. Different substances have different combinations of atoms joined together in different ways, which gives them different properties, such as whether they are solid, liquid or gaseous at room temperature. Many materials we use are mixtures. Mixtures can be separated by processes such as filtration. Polymers have many useful applications. TDA ESA	Key stage 3 chemistry Atoms elements and compounds, pure and impure substances, the periodic table	Some students have ambitions lying in manual labour occupations. Discussing, ideas in this topic in terms of materials they may use or come across, and why certain compounds are used, allows students to see the relevance. Recycling plant?	
	4. Chemistry in our world Acids react with metals, alkalis and bases to produce compounds known as salts. Many chemical reactions produce a change in	Key stage 3 chemistry Chemical reactions. Earth and atmosphere	Reactions discussed in every day terms; students are aware of fire and	Oracy development in debates over anthropogenic

3 hrs 1 hrs	temperature. Chemical reactions can be made to go faster or slower by changing the conditions. The Earth's atmosphere has changed over billions of years. Human activities increase the amounts of some substances in the atmosphere. Water that is safe to drink is essential for human health. TDA ESA		cleaning chemical for example. Soap maker?	climate change.
14hrs 3 hrs 1 hrs	5. Energy, forces and the structure of matter Forces are pushes or pulls, and if a force causes an object to move then work is done and energy is transferred. Energy can be transferred usefully, stored or dissipated, but cannot be created or destroyed. A braking force will cause an energy transfer that makes a vehicle slow down and heats the brakes. The braking distance of a vehicle depends on many different things, such as the speed of the vehicle. The energy resources available to use may be divided into renewable and non-renewable. Energy can also be released from atoms, which contain smaller particles such as neutrons and protons in the nucleus, because atoms can break down to emit particles or gamma rays. TDA ESA	Key stage 3 energy and forces topics. Magnetism, the particle model	Forces explored in relatable terms, e.g. forces on a football or a car. Mechanics, break pads.	Resilience when discussing unpleasant topics such as driving fatalities due to road conditions or driving under influence resulting in greater thinking and stopping distances.

14 3 hrs 1 hrs	6. Electricity, magnetism and waves Electricity is used in domestic and industrial situations to supply energy. Electric current is a flow of electrical charge and measured in amps. Direct current (d.c.) is supplied by cells and alternating current (a.c.) is supplied by the mains, but in both cases the size of the current depends on the resistance in the circuit. When a current flows through a coil of wire an electromagnet is formed, which like permanent magnets, can exert a force over a distance. Electric currents can also be used to produce electromagnetic waves, which have many uses including the transmission of information and the transfer of energy from one place to another. TDA ESA	Key stage 3 electricity and magnetism topics, static electricity	Students love their phones, getting them to explore what they know about their phones and their circuitry etc. is a good way to make the lesson relatable. Electrician.	Debates surrounding energy production through renewable and non-renewable means.
Entries and Codes: • Single Award entry code: 5961 • Double Award entry code: 5962				

3. Combined Science Trilogy

Long Term Plans:

KS4 Course: Combined Science Trilogy (Year 1)
Lead Teacher: Adam
Provision type: classroom based
Aims and Learning Outcomes: • GCSE study in combined science provides the foundations for understanding the material world. Scientific understanding is changing our lives and is vital to the world's future prosperity, and all students should be

taught essential aspects of the knowledge, methods, processes and uses of science. They should be helped to appreciate how the complex and diverse phenomena of the natural world can be described in terms of a small number of key ideas relating to the sciences which are both inter-linked, and are of universal application. These key ideas include:
•the use of conceptual models and theories to make sense of the observed diversity of natural phenomena
•the assumption that every effect has one or more cause
•that change is driven by differences between different objects and systems when they interact
•that many such interactions occur over a distance and over time without direct contact
•that science progresses through a cycle of hypothesis, practical experimentation, observation, theory development and review
•that quantitative analysis is a central element both of many theories and of scientific methods of inquiry.
These key ideas are relevant in different ways and with different emphases in the three subjects as part of combined science: examples of their relevance are given for each subject in the introductions: Biology subject content, Chemistry subject content and Physics subject content. GCSE specifications in combined award science should enable students to:
•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, both 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.
Biology, chemistry and physics should be studied in ways that help students to develop curiosity about the natural world, insight into how science works, and appreciation of its relevance to their everyday lives. The scope and nature of such study should be broad, coherent, practical and satisfying, and thereby encourage students to be inspired, motivated and challenged by the subject and its achievements.

Assessment Objectives:

Assessment objectives (AOs) are set by Ofqual and are the same across all GCSE Combined Science: Trilogy specifications and all exam boards. The exams will measure how students have achieved the following assessment objectives.
•AO1: Demonstrate knowledge and understanding of: scientific ideas; scientific techniques and procedures.

•AO2: Apply knowledge and understanding of: scientific ideas; scientific enquiry, techniques and procedures. •AO3: Analyse information and ideas to: interpret and evaluate; make judgments and draw conclusions; develop and improve experimental procedures				
Suggested Timing	Unit/Topic	Where it has been seen before	Life Link/Work Experience	Cultural Capital/CORE
24hrs 27hrs	Unit 1 – Cell Biology and organisation Cells are the basic unit of all forms of life. In this section we explore how structural differences between types of cells enables them to perform specific functions within the organism. These differences in cells are controlled by genes in the nucleus. For an organism to grow, cells must divide by mitosis producing two new identical cells. If cells are isolated at an early stage of growth before they have become too specialised, they can retain their ability to grow into a range of different types of cells. This phenomenon has led to the development of stem cell technology. This is a	Old KS3 topics: Cells and organisation Genetics and evolution. Old KS3: Year 7 – atoms elements and compounds. Year 8 periodic table	Ideas of genes controlling cells and genetic conditions relate to real life, as students have friends/family with conditions that they can understand. Cancer research UK talk? Severn Trent Water?	Opportunities to develop character and oracy by debating ethics surrounding stem cell usage and genetic conditions. Opportunities to develop character as students grapple with abstract ideas beyond themselves and daily life. Students may gain an appreciation for being part of a wider whole, made of the same 'stuff' as

	new branch of medicine that allows doctors to repair damaged organs by growing new tissue from stem cells. Atomic structure and the periodic table The periodic table provides chemists with a structured organisation of the known chemical elements from which they can make sense of their physical and chemical properties. The historical development of the periodic table and models of atomic structure provide good examples of how scientific ideas and explanations develop over time as new evidence emerges. The arrangement of elements in the modern periodic table can be explained in terms of atomic structure which provides evidence for the model of a nuclear atom with electrons in energy levels.			everything else.
12hrs	Unit 3 – Infection and response.	Old KS3 Health (Year 7)	Students will be able to relate to the topic as it links	Oracy skills utilised when discussing their thoughts

	Pathogens are microorganisms such as viruses and bacteria that cause infectious diseases in animals and plants. They depend on their host to provide the conditions and nutrients that they need to grow and reproduce. They frequently produce toxins that damage tissues and make us feel ill. This section will explore how we can avoid diseases by reducing contact with them, as well as how the body uses barriers against pathogens. Once inside the body our immune system is triggered which is usually strong enough to destroy the pathogen and prevent disease. When at risk from unusual or dangerous diseases our body's natural system can be enhanced by the use of vaccination. Since the 1940s a range of antibiotics have been developed which have proved successful against a number of lethal diseases caused by bacteria.	Cells and organisation (year 7)	strongly to the current coronavirus pandemic. Hospital visit? Jay in for a talk? Sue's experience as a nurse.	on the coronavirus and the efficacy of lockdown restrictions, given the knowledge they have gained throughout the topic. Ethics will also be discussed in a similar fashion.

	Unfortunately many groups of bacteria have now become resistant to these antibiotics. The race is now on to develop a new set of antibiotics.			
15hrs	Inheritance, variation and evolution In this section we will discover how the number of chromosomes are halved during meiosis and then combined with new genes from the sexual partner to produce unique offspring. Gene mutations occur continuously and on rare occasions can affect the functioning of the animal or plant. These mutations may be damaging and lead to a number of genetic disorders or death. Very rarely a new mutation can be beneficial and consequently, lead to increased fitness in the individual. Variation generated by mutations and sexual reproduction is the basis for natural selection; this is how species	Old KS3 Genetics and evolution (Year 9)	Coronavirus outbreak as well as friends/family with genetic conditions are both relatable issues rooted in the ideas of inheritance, variation and evolution. Natural history museum. Attenborough. Zebra fish man?	Resilience will be developed when discussing perhaps uncomfortable topics of genetic disorders. Plenty of opportunities to develop oracy skills with many ethical debates about conditions and sensitivity to these issues.

	evolve. An understanding of these processes has allowed scientists to intervene through selective breeding to produce livestock with favoured characteristics. Once new varieties of plants or animals have been produced it is possible to clone individuals to produce larger numbers of identical individuals all carrying the favourable characteristic. Scientists have now discovered how to take genes from one species and introduce them in to the genome of another by a process called genetic engineering. In spite of the huge potential benefits that this technology can offer, genetic modification still remains highly controversial.			
12hrs	Organic Chemistry The chemistry of carbon compounds is so important that it forms a separate branch of chemistry. A great variety of carbon compounds	Year 7: Atoms elements and compounds The particle model	Should be easily relatable as every single living thing we know of is carbon based. Further, organic compounds	Character building may ensue when discussing human consumption of carbon compounds and the output

	is possible because carbon atoms can form chains and rings linked by C-C bonds. This branch of chemistry gets its name from the fact that the main sources of organic compounds are living, or once-living materials from plants and animals. These sources include fossil fuels which are a major source of feedstock for the petrochemical industry. Chemists are able to take organic molecules and modify them in many ways to make new and useful materials such as polymers, pharmaceuticals, perfumes and flavourings, dyes and detergents	Year 8: Chemical reactions	such as oil and other fossil fuels with which we are familiar stem from once-living plants/animals. Ratcliffe powerplant. Pharamceutical chemistry.	of carbon from human society
Entries and Codes: • AQA GCSE in Combined Science: Trilogy Foundation 8464F Higher8464H				

4. Cambridge National Sports Science

Long Term Plans:

KS4 Course: Sports Science Condensed (one year course)
Lead Teacher: Danny
Provision type: Onsite
Aims and Learning Outcomes: Learners will know how to prepare participants to take part in physical activity in a way which minimises the risk of injuries occurring, how to react to common injuries that can occur during sport and how to recognise the symptoms of some common medical conditions, providing a good foundation to undertake formal first aid training and qualifications. Learners will consider the variety of ways in which technology is being used in sport to enhance both performance and the experience of sport for performers and for spectators. They will also develop an appreciated of some of the counter-arguments regarding the increasing use of technology in sport. Learners will develop knowledge and understanding of the principles and methods of training and the application of these in the design of training programmes along with practical skills in fitness testing. Learners will understand key aspects of the structure and function of the musculo-skeletal and cardio-respiratory systems and investigate some of the changes which occur to them in response to short and long-term physical activity.
Assessment Objectives: **Topic:** Technology in sport To Know how technology is used in sport and to understand the positive effects of sports technology has upon various sports and spectators. The students will also understand the negative effects of sports technology as well as being able to evaluate the impact certain technologies have had upon various sports. **Topic:** Applying principles of training Students will know the principles of training in a sporting context and be able to identify how training methods target different fitness components. Students will then conduct a series of fitness tests before identifying an area to improve and undertaking a 6 week training programme. **Topic:** Body's response to physical activity Students will know the key components of the musculo-skeletal and cardio-respiratory systems, their functions and roles as well as understanding the importance of the musculo-skeletal and cardio-respiratory systems in health and fitness. Students will be shown how to assess the short and long-term effects of physical activity on the musculo-skeletal and cardio-respiratory systems. **Topic:** Reducing the risk of sporting injuries

Apply knowledge and understanding of; sporting events, participants, techniques and link this to the prevention of injuries.
To understand different factors which influence the risk of injury and to be able to link certain sporting injuries to a particular sport.
To understand how appropriate warm up and cool down routines can help to prevent injury and the importance of undertaken a rigorous warm up before physical activity and a thorough cool down after any prolonged period of activity.
To know how to respond to injuries within a sporting context and the procedures needed before leading any sessions.
To know how to respond to common medical conditions and why this is important when playing sport.

Suggested Timing	Unit/Topic	Where it has been seen before	Life Link/Work Experience	Cultural Capital/CORE
3-4hrs 1.5 hours 5-6hrs	Technology in sport The importance of being ahead of the game when it comes to innovation. How technology is used to enhance performance, game play and spectatorship. LO1 Know how fitness testing, training aids, equipment, injury prevention and recovery, clothing and footwear impacts athletes. How technology is used to enhance game play. Know the impact of video	Key stage 3 (PE lesson)	Knowing jobs and careers that are available due to these technologies. Use of various presentation skills. How certain technologies work. Use of infrared, speed guns. Discussions regarding aerodynamics and how this works. Applying maths to the sporting technologies. Editorial skills, how to present a news article. Research skills using the internet and other forms of informative tools such as libraries. The importance of opinion in sport. The use of debating and	Technology is everywhere and is an important tool to enjoy sport even more than we do already. How it can be used to improve general fitness and sport aims and goals.

2hrs-3hrs 2hrs	refereeing, hawk eye, goal line technology, hotspot, radio and stadiums impacts sports. How technology is used to enhance spectatorship. The impact of stadiums, officials, punditry, TV and. internet has on fans and enjoyment. How tradition is effected. How rule and regulations need changing to accommodate new technologies. Midpoint assessment- LO2 and 3- the positves and negative impact of technologies on performance, gameplay and spectatorship. Endpoint assessment- L04- Evaluation of a certain technology in depth.		listening to others. information/opinion when articulating in a discussion	
5-6hrs	To know the key components of the musculo-skeletal system. Changes in heart rate, breathing rate and other key aspects related to the cardio-	Key stage 3 (PE lesson)	Learn about careers in the sport industry that require strong knowledge and understanding of how the body changes during exercise.	Students will get a better understanding of the musculoskeletal system and the cardiorespiratory system. This will help them make

	respiratory system in the short term. To know the key components of the cardio respiratory system. Assessment waypoint- (ongoing each lesson- resources used to complete LO1 and 2.		Research into various categories that can seriously harm the body. Research skills using the internet and other forms of informative tools such as libraries. Design suitable activities using previous knowledge to measure both short term and long term effects of exercise. Methods to record outcomes of various tests. Design and planning of tests so they are done in the correct order. Skills on excel documenting pre and post work out results.	better decisions on how best to keep healthy and the effects various stimulants can have.
1-2hrs	To know the impact diet, stress and obesity has upon the body. How the body benefits from improving muscular strength and flexibility. Way point			
1hr	Assessment LO3.			
5-6hrs	Changes in heart rate, breathing rate and other key aspects related to the cardio-respiratory system in the long term. To know suitable methods to measure the short term and long term effects of exercise. Endpoint assessment LO3 and 4 (done throughout using various resources).			

2-3hrs 1hr 3-4hrs 1hr 2-3hrs	To know the 10 component of fitness. To know what FITTA is. To know what PROS is. Will know how to respond to these in a sporting context. Assessment way point LO1 Know how training methods target different components of fitness. To know the difference between aerobic and anaerobic exercise. To know the tests of all 10 components of fitness. Waypoint assessment LO2 To know how to interpret results from the tests undertaken and to identify CofF that need improving.	Key stage 3 (PE lesson)	To become a Personal trainer and to learn about how to set various programmes up. Learn how to set up tests safely. To use various scientific equipment to help complete the components of fitness testing. To complete a gym induction (Covid pending). Be able to set Smart targets and achievable goals. Complete tests that are valid and reliable. Be able to develop fitness training programmes. Evaluating skills will improve when identifying where training could have been improved. Patience and determination will improve with the completion of the programme.	Students will get experience in using gym equipment and various different training styles to help them train and target a specific area in fitness. It will allow them to set targets and help them with deadlines

1hr 8-9hrs 2-3hrs	Waypoint assessment L03 To know which tests are maximal tests and which ones are sub maximal. To design complete and evaluate a 6 week training program. Endpoint assessment L04			
6-7 Hrs 1 Hrs 6-7 hrs 1 hour	To know how various extrinsic influences could affect the chances of injury. To know how various intrinsic influences could affect the chances of injury. To know how poor posture can lead to various sports injuries such as pelvic tilt and kyphosis. WayPoint Assessment To understand how appropriate warm ups help reduce the chance of injuries. To understand how appropriate cool downs help reduce the chance of injuries. To know how to respond to	Key stage 3 (PE lesson)	Take part in basic first aid To be able to distinguish between acute and chronic injuries. Be able to give advice using RICE to acute injuries suffered in sport and in general day to day life. To undertake a Risk assessment. To undertake an Emergency action plan and be able to locate emergency exists in certain key places. To know what cramp is and how to prevent it and get rid of it. Will be able to work out heart rates, training zones and be able to utilise these skills in other units. Will gain skills to be able to organise	Will allow students to gain skills that could be needed to help somebody who has suffered an injury/medical condition. Gives them a base knowledge to set them up for first aid courses in the future

	an injury in sport setting Know how to respond to certain medical conditions. Endpoint assessment		and run warm up sessions.	

Entries and Codes:

- entry code: J812

R041
R042
R043
R046