GCSE Biology

Units of Work

Year – Term – Unit	Summary of Learning Content
Year 1 – Autumn Term- Cell Biology	How have scientists developed their understanding of cell structure and function? • The structures inside cells do different jobs within the cell. • Cells can be studied using different types of microscopes. • The cells of bacteria are different from the cells of plants and animals. How do organisms obtain their energy from food? • Anaerobic respiration: when some organisms run out of oxygen, they can respire without it. • Many microorganisms can respire anaerobically, as can the muscles of mammals for short periods. Why is it important to study microorganisms, and how do we grow them in the lab and commercially? • The biochemistry of fermentation is involved in the production of alcoholic drinks and bread. • Lab techniques are used to grow, or culture, microorganisms. • Micro-organisms reproduce, and the number of bacteria produced can be estimated. • Tests can show how effective antibiotics, antiseptics and disinfectants are at inhibiting the growth of bacteria.
Year 1 – Autumn Term- Transport in Cells	Do all materials move by diffusion? • Water moves from a high concentration of water to a lower concentration of water in living tissues by osmosis. • The movement of water can affect the turgidity of living cells. • Some substances that living cells need can be moved against a concentration gradient. Do all organisms move materials in the same way? • Small organisms do not have specialised organs for gaseous exchange or transport of some materials. • Fish and mammals have evolved specialised exchange surfaces for gaseous exchange. • Fish and mammals have specialised transport systems. What is active transport?

	Minerals are taken up into root hair cells of a plant by active transport Substances move against the concentration gradient when plants absorb ions from the soil.
Year 1- Spring Term-Tissues, Organs and Organ systems	How do we develop into a complex organism from just a fertilised egg cell? • The body's cells divide and the newly formed cells are identical to the existing cells. • Cells differentiate to become specialised, and specialised cells are organised. • Cells that are unspecialised in the embryo, and cells that remain unspecialised in us as adults, are called stem cells. Why do some organisms need organ systems? • Size affects the ability and efficiency of diffusion alone to supply cells with nutrients. • Membrane surfaces and organ systems are specialised for exchanging materials to ensure that all body cells get the nutrients that they need. How does the digestive system work? • The digestive system is made up of many organs • The organs work together to change the structure or our food in order to nourish the body • There are specific enzymes in the digestive system; their action is affected by different factors What is the function of the circulatory system? • Very small animals have no need for a transport system • As the distance from the internal cells to the animals surface increases, a transport system becomes vital
Year 1- Spring Term-Plant cell organisation	How do plants special adaptations help them survive and get all they need from the environment? • Adaptations of cells and tissues in leaves allow them to photosynthesis efficiently. • Stomata are adapted to control the exchange of gases. • Cells and tissues in leaves, stems and roots are designed for the maximum exchange of substances in and out of the plant. What factors affect the photosynthesis reaction? How do they affect it? • The useful products of photosynthesis are simple carbohydrates, for example glucose and sucrose. • Different environmental factors interact to limit the rate of photosynthesis in different habitats at different times.

	• The environment in which plants are grown can be artificially manipulated. How is the supply of water to a plant affected by environmental conditions? • There are two transport systems in plants: xylem transports water up the plant and phloem transports • Substances up and down the plant. • Water movement through the plant is affected by different environmental factors. • Water loss in plants is a consequence of adaptations for photosynthesis. Diffusion also allows substances to pass in and out of cells. Which substances diffuse into plants? • Different factors affect the rate of diffusion in plant systems. • Concentration gradients can affect the rate of photosynthesis. • Substances move in and out of the leaf during different processes, for example, photosynthesis, respiration and transpiration.
Year 1 – Summer Term- Health Matters	Factors that affect our chances of catching a non-communicable disease. • Factors in our environment can increase our risk of disease. Our lifestyle can increase the chance of us developing a non-communicable disease. • Sometimes a number of risk factors for developing a disease interact. • Lifestyle factors can increase the risk of a person developing cancer. How are communicable diseases spread? • Pathogens are microorganisms that cause disease in plants and animals. • Bacteria, viruses, fungi and protists can cause disease. • Toxins produced by bacteria make us feel ill. • Understanding the lifecycles of some pathogens allows us to control the spread of disease. How do we control the spread of disease? • The skin, nose, respiratory system and stomach all protect us from pathogens. • The immune system is our major defence system against disease. • White blood cells protect us from bacterial infections in a number of ways.

	• Vaccination protects us from viral and bacterial pathogens. How are plants affected by disease and protected from attack? • Plant diseases can usually be detected by visible symptoms. • Viral, bacterial and fungal pathogens cause plant diseases. • Plants have physical, mechanical and chemical defence systems to protect them from attack by herbivores.
Year 2 – Autumn Term- Co-ordination and Control	Conditions in the body, processes and organ systems are co-ordinated and controlled. • Regulation of the internal conditions in the body is called homeostasis. • The nervous and endocrine systems are involved in this coordination and control. • The nervous system works using electrical impulses, transmitted using nerves; the endocrine system uses chemicals called hormones, which are secreted by endocrine glands. • In the nervous system, receptors can be grouped into sense organs, such as the eye. • Different regions of the brain coordinate our responses, though spinal reflexes can by-pass it. • The brain is a delicate and complicated structure, and this has consequences in its mapping and treatment of nervous system disorders. • Temperature regulation is controlled by the brain and involves both the endocrine and nervous systems. Control of metabolism and levels of chemicals in the body. • The concentrations of glucose, water and salts must be kept within strict limits. • Glucose concentrations and water balance are controlled by hormones. • Lack of insulin, or a loss of sensitivity to it, causes a condition called diabetes, which must be controlled. • The kidneys filter substances from the blood, excrete the waste products and reabsorb substances that are useful. • Kidney failure requires dialysis or a transplant, and there are advantages and disadvantages to both. • The control of hormone secretion by many glands is by negative feedback. Control of sexual development and human reproduction.

	• Reproductive hormones cause secondary sexual characteristics to develop. • Pituitary gland hormones regulate egg development and release, and along with reproductive hormones, prepare the body for a possible pregnancy. • Different methods of contraception help to prevent unwanted births. • Fertility drugs and in-vitro fertilisation are possible solutions to infertility. Plants respond to stimuli to control important processes. • Growth movements are called tropisms and these are brought about by hormones called auxins. • Other hormones include gibberellins and ethene, and these control seed germination, cell division and fruit ripening. • Plant hormones have many applications in horticulture and agriculture.
Year 2 – Spring Term- Genetics	Our understanding of DNA and the way genes work. • DNA is a polymer made up of units called nucleotides. • A gene is a short section of DNA that codes for the production of a particular protein. • The code for the synthesis of each protein is carried by a sequence of chemicals called bases. • Proteins are synthesised from the DNA template. • The unique structure of each protein enables it to do a particular job. • Mutations occur when errors are made copying DNA. • The Human Genome Project (HGP) is increasing our understanding of DNA which will lead, in the future, to personalised medicine. • Because of the HGP, we now know that not all genes that are present control protein synthesis. Production of sex cells for reproduction. • In asexual reproduction, only one parent is involved. • No sex cells are produced and cells divide by mitosis. • During sexual reproduction, a cell divides by meiosis to produce four gametes, each with half the number of chromosomes. • Meiosis ensures that we keep our chromosome number constant - 46, or 23 pairs - in each generation. • Meiosis also produces gametes that are genetically unique, leading to variation between individuals.

	• Our sex is determined by the 23rd pair of chromosomes. • The way chromosomes are inherited means that the number of boys who are born is roughly same as the number of girls. Characteristics are inherited from one generation to the next. • The science of genetics was established by the work of Austrian monk, Gregor Mendel. • Genetics allows us to understand the inheritance of certain characteristics in humans and in many other organisms. • We can use genetic terms and predict the outcome of crosses. • Genetics enables us to track the inheritance of certain human diseases, although the inheritance of most is more complex.
Year 2 – Spring Term- Variation and Evolution	What causes variation and what are its effects on The individual? • Variation has genetic and environmental causes. • Nutation, sexual reproduction and meiosis are processes that lead to variation. • Variation results in differences in phenotypes and genotypes in a population. How do variation, a struggle for existence and natural selection lead to the evolution of new species? • In any population, there is a struggle for existence. • Because of variation, some individuals are better suited to the environment, so they reproduce and pass on their genes to the next generation, a process called natural selection. • Natural selection acts on populations, and if the environment changes a new species may result, by the • Processes of evolution and speciation. • In 1858, Charles Darwin and Alfred Russel Wallace proposed separately the theory of evolution. • The evidence for natural selection and evolution comes from observations of current organisms, the fossil record and biochemistry, including DNA. • During the 100 years that followed the theory, many scientists pieced together the connection between • Inheritance, genetics, evolution, genes and the genetic code.

	• Humans can also change the genetic make-up of organisms by selective breeding and genetic engineering. • Fossils are used to create evolutionary trees to help understand the relationships between groups of organisms. What are the causes of extinctions? • Extinction arises from changes in the environment, diseases and the introduction of new species that are • Predators or out compete existing species. • The five mass extinctions to date are thought to have been caused by climate change, or a catastrophic event such as a volcanic eruption or a collision with an asteroid.
Year 2 – Summer Term- Ecology in Action	Natural factors affect living organisms in a habitat • How energy is lost from each trophic level in a food chain. • Why there is a maximum size to food chains. • How pyramids of biomass show the mass of organisms in a food chain. • How different groups of decomposers break down dead animal and plant matter. • How distribution and numbers of species are sampled. How do plants and animals within a community interact? • How a change in an abiotic (non-living) factor affects a community. • How changes in biotic (living) factors affect a community. • How organisms are adapted to survive in extreme habitats. • Why animals compete for resources in a habitat. How do human activities affect biodiversity? • What biodiversity is and why it is important to maintain a good level of biodiversity. • How human population growth has impacted on the use of land and how this affects biodiversity. • How waste from human activities has affected the atmosphere and biodiversity. • How biodiversity can be maintained.

	How are materials in a community cycled? • How carbon is cycled from organisms to the atmosphere. • How water is cycled to provide a constant source of fresh water. • How microorganisms help in cycling materials through an ecosystem. • How we use the process of decay to produce compost and biogas.

End of Course Exams

Paper 1		
What's assessed Cell biology Organisation Infection and response Bioenergetics.	**How it's assessed** Written exam: 1 hour 45 minutes Foundation and Higher Tier 100 marks 50% of GCSE	**Questions** Multiple choice, structured, closed short answer and open response.
Paper 2		
What's assessed Homeostasis and response Inheritance, variation and evolution Ecology	**How it's assessed** Written exam: 1 hour 45 minutes Foundation and Higher Tier 100 marks 50% of GCSE	**Questions** Multiple choice, structured, closed short answer and open response.