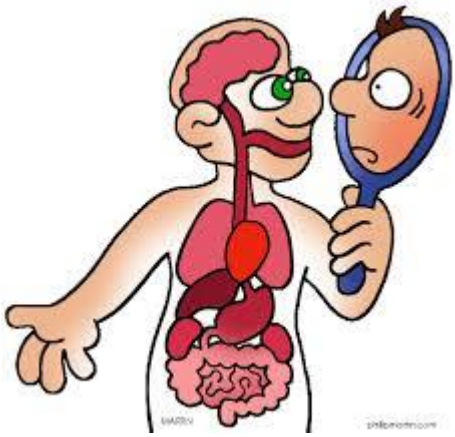
Year 11 AQA GCSE Biology Revision Checklist

Use this booklet to help you with your revision in preparation for your GCSE Biology examinations.

This is the work that you will have covered by the end of year 11 from the GCSE Syllabus Examination

How can you use this document to help you revise?

By looking at this document you can see the extent of the work that you need to fully cover and revise before you sit your GCSE examinations. This will then help you to track your progress through the year and also plan your revision for the summer examinations. Careful study and use of this document will ensure that you have sufficient time to cover all the work well before the exam.



BIOLOGY

Cell structure			
Describe that plant and animal cells (eukaryotic cells) have a cell membrane, cytoplasm and genetic material enclosed in a nucleus.			
Structure of bacterial cells (prokaryotic cells)			
Be able to demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, including the use of standard form**.**			
Animal and plant cells			
Be able to explain how the main sub-cellular structures, in animal and plant cells and plasmids in bacterial cells are related to their functions.			
Be able to use estimations and explain what they should be used to judge the relative size or area of sub-cellular structures			
Cell specialisation			
Be able to, when provided with appropriate information, explain how the structure of different types of cell relate to their function in a tissue, an organ or organ system, or the whole organism.			
Cell differentiation			
Explain the importance of cell differentiation.			
In mature animals, cell division is mainly restricted to repair and replacement.			
As a cell differentiates it acquires different sub-cellular structures to enable it to carry out a certain function. It has become a specialised cell			
Microscopy			
Understand how microscopy techniques have developed over time			
Explain how electron microscopy has increased understanding of sub-cellular structures. Differences in magnification and resolution			
Be able to carry out calculations involving magnification, real size and image size using the formula **magnification = size of image / size of real object**			
Be able to express answers in standard form if appropriate			
Culturing microorganisms			
Bacteria multiply by simple cell division (binary fission).			
Bacteria can be grown in a nutrient broth solution or as colonies on an agar gel plate.			
Describe how to prepare an uncontaminated culture using aseptic technique.			
Be able to calculate cross-sectional areas of colonies or clear areas around colonies using πr^2.			
Be able to calculate the number of bacteria in a population after a certain time if given the mean division time.			

Cell division			
Chromosomes			
The nucleus of a cell contains chromosomes made of DNA molecules. Each chromosome carries a large number of genes. In body cells the chromosomes are normally found in pairs			
Mitosis and the cell cycle			
Be able to describe the stages of the cell cycle, including mitosis.			
During the cell cycle the genetic material is doubled and then divided into two identical cells			
Cell division by mitosis is important in the growth and development of multicellular organisms			
Be able to recognise and describe situations in given contexts where mitosis is occurring			
Stem cells			
A stem cell is an undifferentiated cell of an organism which is capable of giving rise to many more cells of the same type, and from which certain other cells can arise from differentiation.			
Be able to describe the function of stem cells in embryos, in adult animals and in the meristems in plants			
Explain how treatment with stem cells may be able to help conditions such as diabetes and paralysis			
Describe the role of stem cell in In therapeutic cloning			
Explain the potential risks and ethical concerns of using stem cells			
Explain how stem cells from meristems in plants can be used to produce clones of plants quickly and economically			
Transport in cells			
Diffusion			
Substances may move into and out of cells across the cell membranes via diffusion.			
Know some of the substances transported in and out of cells by diffusion in named locations in animals and plants			
Be able to explain how factors affect the rate of diffusion.			
A single-celled organism has a relatively large surface area to volume ratio. This allows sufficient transport of molecules into and out of the cell to meet the needs of the organism.			
Be able to calculate and compare surface area to volume ratios.			
Be able to explain the need for exchange surfaces and a transport system in multicellular organisms in terms of surface area to volume ratio			
Know how multicellular organisms, surfaces and organ systems are specialised for exchanging materials. This is to allow sufficient molecules to be transported into and out of cells for the organism's needs.			
Osmosis			
Water may move across cell membranes via osmosis. Osmosis is the diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane.			

Students should be able to: • use simple compound measures of rate of water uptake • use percentiles • calculate percentage gain and loss of mass of plant tissue			
Be able to plot, draw and interpret appropriate graphs.			
Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.			
Active transport			
Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). This requires energy from respiration.			
Active transport allows mineral ions to be absorbed into plant root hairs from very dilute solutions in the soil. Plants require ions for healthy growth.			
It also allows sugar molecules to be absorbed from lower concentrations in the gut into the blood which has a higher sugar concentration.			
Principles of organisation			
Understand that cells are the basic building blocks of all living organisms.			
A tissue is a group of cells with a similar structure and function.			
Organs are aggregations of tissues performing specific functions.			
Organs are organised into organ systems, which work together to form organisms.			
Students should be able to explain how the structures of plant tissues are related to their functions. Plant tissues include:epidermal tissues, palisade mesophyll, spongy mesophyll, xylem and phloem, meristem tissue found at the growing tips of shoots and roots. The leaf is a plant organ. Knowledge limited to epidermis, palisade and spongy mesophyll, xylem and phloem, and guard cells surrounding stomata.			
Students should be able to explain how the structure of root hair cells, xylem and phloem are adapted to their functions. Students should be able to explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration.			
Students should be able to understand and use simple compound measures such as the rate of transpiration.			
The roots, stem and leaves form a plant organ system for transport of substances around the plant.			
Root hair cells are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport.			
Students should be able to describe the process of transpiration and translocation, including the structure and function of the stomata.			
Xylem tissue transports water and mineral ions from the roots to the stems and leaves. It is composed of hollow tubes strengthened by lignin adapted for the transport of water in the transpiration stream.			
The role of stomata and guard cells are to control gas exchange and water loss.			
Phloem tissue transports dissolved sugars from the leaves to the rest of the			

plant for immediate use or storage. The movement of food molecules through phloem tissue is called translocation.			
Phloem is composed of tubes of elongated cells. Cell sap can move from one phloem cell to the next through pores in the end walls. Detailed structure of phloem tissue or the mechanism of transport is not required.			
Digestive enzymes convert food into small soluble molecules that can be absorbed into the bloodstream.			
Carbohydrases break down carbohydrates to simple sugars. **Amylase** is a carbohydrase which breaks down starch. **Proteases** break down proteins to amino acids. **Lipases** break down lipids (fats) to glycerol and fatty acids			
Bile is made in the liver and stored in the gall bladder. It is alkaline to neutralise hydrochloric acid from the stomach. It also emulsifies fat to form small droplets which increases the surface area. The alkaline conditions and large surface area increase the rate of fat breakdown by lipase			
Use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict's test for sugars; iodine test for starch; and Biuret reagent for protein.			
Use a continuous sampling technique to determine the time taken to completely digest a starch solution at a range of pH values. Iodine reagent is to be used to test for starch every 30 seconds. Temperature must be controlled by use of a water bath or electric heater			
Metabolism			
Be able to explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids.			
Metabolism is the sum of all the reactions in a cell or the body. The energy transferred by respiration in cells is used by the organism for the continual enzyme controlled processes of metabolism that synthesise new molecules.			

Bioenergetics			
Photosynthesis			
Photosynthesis is represented by the equation: carbon dioxide + water light glucose + oxygen Students should recognise the chemical symbols: CO_2, H_2O, O_2 and $C_6H_{12}O_6$.			
Be able to describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.			
Be able to explain the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll on the rate of photosynthesis and be able to calculate rates of photosynthesis using data			

Explain how these factors interact and any one of them may be the factor that limits photosynthesis. (HT only) Students should be able to explain graphs of photosynthesis rate involving two or three factors and decide which is the limiting factor.			
Understand and use inverse proportion – the inverse square law and light intensity in the context of photosynthesis. Limiting factors are important in the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit			
Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed			
Uses of glucose from photosynthesis			
Plant defence responses			
Be able to describe physical and chemical plant defence responses.			
Know how to detect and identify plant diseases			
Describe how plants can be infected by a range of viral, bacterial and fungal pathogens as well as by insects.			
Knowledge of plant diseases is restricted to tobacco mosaic virus as a viral disease, black spot as a fungal disease and aphids as insects.			
Plants can be damaged by a range of ion deficiency conditions:			
Respiration			
Aerobic and anaerobic respiration			
Be able to describe cellular respiration as an exothermic reaction which is continuously occurring in living cells and supplies all the energy needed for living processes.			
Respiration in cells can take place aerobically (using oxygen) or anaerobically (without oxygen), to transfer energy and should know the differences between them.			
Know the equations for aerobic and anaerobic respiration			
Anaerobic respiration in yeast cells is called fermentation and has economic importance in the manufacture of bread and alcoholic drinks.			
Response to exercise			
Describe and explain how the human body reacts to the increased demand for energy during exercise including the effects of anaerobic respiration in muscles			
Blood flowing through the muscles transports the lactic acid to the liver where it is converted back into glucose. Oxygen debt is the amount of extra oxygen the body needs after exercise to react with the accumulated			
The heart and blood vessels			
Know the structure and functioning of the human heart and lungs, including how lungs are adapted for gaseous exchange.			
Know the role of pacemaker and how artificial pacemakers are used to correct irregularities in the heart rate.			
The body contains three different types of blood vessel: Be able to explain how the structure of these vessels relates to their			

functions.			
Be able to use simple compound measures such as rate and carry out rate calculations for blood flow.			
Blood			
Describe and explain the structure and function of the different parts of blood tissue			
Be able to recognise different types of blood cells in a photograph or diagram, and explain how they are adapted to their functions.			
Coronary heart disease: a non-communicable disease			
Describe the main features and treatments of coronary heart disease, and evaluate their effectiveness			
Understand the consequences and treatments of faulty heart valves.			
Know artificial hearts are occasionally used to keep patients alive whilst waiting for a heart transplant, or to allow the heart to rest as an aid to recovery.			
Health issues			
Be able to describe the relationship between health and disease and the interactions between different types of disease.			
Diseases, both communicable and non-communicable, are major causes of ill health. Other factors including diet, stress and life situations may have a profound effect on both physical and mental health.			
Be able to translate disease incidence information between graphical and numerical forms, construct and interpret frequency tables and diagrams, bar charts and histograms, and use a scatter diagram to identify a correlation between two variable			
Understand the principles of sampling as applied to scientific data, including epidemiological data.			
The effect of lifestyle on some non-communicable diseases			
Discuss the human and financial cost of these non-communicable diseases to an individual, a local community, a nation or globally • explain the effect of lifestyle factors including diet, alcohol and smoking on the incidence of non-communicable diseases at local, national and global levels.			
Know various risk factors are linked to an increased rate of a disease. Many diseases are caused by the interaction of a number of factors			
Be able to understand the principles of sampling as applied to scientific data in terms of risk factors			
Be able to translate information between graphical and numerical forms; and extract and interpret information from charts, graphs and tables in terms of risk factors.			
Be able to use a scatter diagram to identify a correlation between two variables in terms of risk factors.			
Cancer			
Be able to describe cancer as the result of changes in cells that lead to uncontrolled growth and division.			
Know the features and differences of benign and malignant tumours			

There are also genetic risk factors for some cancers.			
Communicable diseases			
Be able to explain how diseases caused by viruses, bacteria, protists and fungi are spread in animals and plants. Students should be able to explain how the spread of diseases can be reduced or prevented.			
Viral diseases			
Viruses live and reproduce inside cells, causing cell damage.			
Measles HIV Tobacco mosaic virus (TMV)			
Bacterial diseases			
Bacteria may produce poisons (toxins) that damage tissues and make us feel ill.			
Salmonella Gonorrhoea			
Fungal diseases			
Rose black spot			
Protist disease			
The pathogens that cause malaria are protists.			
Human defence system			
Be able to describe the non-specific defence systems of the human body against pathogens,			
Be able to explain the role of the immune system in the defence against disease.			
Vaccination			
Be able to explain how vaccination will prevent illness in an individual, and how the spread of pathogens can be reduced by immunising a large proportion of the population.			
Describe and explain how vaccinations work to provide immunity			
Antibiotics and painkillers			
Be able to explain the use of antibiotics and other medicines in treating disease			
Antibiotics, such as penicillin, are medicines that help to cure bacterial disease by killing infective bacteria inside the body. It is important that specific bacteria should be treated by specific antibiotics			
The use of antibiotics has greatly reduced deaths from infectious bacterial diseases. However, the emergence of strains resistant to antibiotics is of great concern.			
Know that antibiotics cannot kill viral pathogens.			
Know that painkillers and other medicines are used to treat the symptoms of disease but do not kill pathogens.			
Describe how it is difficult to develop drugs that kill viruses without also damaging the body's tissues			
Discovery and development of drug			
Be able to describe the process of discovery and development of potential new medicines, including preclinical and clinical testing.			
Traditionally drugs were extracted from plants and microorganisms.			

• The heart drug digitalis originates from foxgloves. • The painkiller aspirin originates from willow. • Penicillin was discovered by Alexander Fleming from the Penicillium mould.			
Know that most new drugs are synthesised by chemists in the pharmaceutical industry.			
Describe how new medical drugs have to be tested and trialled before being used to check that they are safe and effective.			
Preclinical and clinical trials check the effectiveness and safety of a drug			
Monoclonal antibodies			
Be able to describe how monoclonal antibodies are produced.			
Be able to describe some of the ways in which monoclonal antibodies can be used e.g. in pregnancy test and treating cancer			
Homeostasis and response			
Be able to explain that homeostasis is the regulation of the internal conditions of a cell or organism to maintain optimum conditions for function in response to internal and external changes.			
In the human body, these include control of: • blood glucose concentration • body temperature • water levels.			
All control systems include: • cells called receptors, which detect stimuli (changes in the environment) • coordination centres (such as the brain, spinal cord and pancreas) that receive and process information from receptors • effectors, muscles or glands, which bring about responses which restore optimum levels.			
The human nervous system			
Be able to explain how the structure of the nervous system is adapted to its functions.			
Information from receptors passes along cells (neurones) as electrical impulses to the central nervous system (CNS).			
The CNS is the brain and spinal cord.			
Be able to explain how the various structures in a reflex arc – including the sensory neurone, synapse, relay neurone and motor neurone – relate to their function.			
Understand why reflex actions are important.			
Be able to extract and interpret data from graphs, charts and tables, about the functioning of the nervous system			
Be able to translate information about reaction times between numerical and graphical forms.			
The brain			
Be able to identify the cerebral cortex, cerebellum and medulla on a diagram of the brain, and describe their functions.			
Be able to explain some of the difficulties of investigating brain function and treating brain damage and disease.			
Know how neuroscientists have been able to map the regions of the brain			

The eye			
Be able to relate the structures of the eye to their functions.			
Be able to identify the following structures on a diagram of the eye and explain how their structure is related to their function: • retina • optic nerve • sclera • cornea • iris • ciliary muscles • suspensory ligaments.			
Know that accommodation is the process of changing the shape of the lens to focus on near or distant objects.			
Describe how two common defects of the eyes are myopia (short sightedness) and hyperopia (long sightedness) in which rays of light do not focus on the retina, how they are treated			
Be able to interpret ray diagrams, showing these two common defects of the eye and demonstrate how spectacle lenses correct them.			
Control of body temperature			
Describe how body temperature is monitored and controlled by the thermoregulatory centre in the brain.			
Describe how the skin contains temperature receptors and sends nervous impulses to the thermoregulatory centre.			
Be able to explain how mechanisms lower or raise body temperature in a given context			
Plant hormones			
Be able to explain plants produce hormones to coordinate and control growth and responses to light (phototropism) and gravity (gravitropism or geotropism).			
Describe how unequal distributions of auxin cause unequal growth rates in plant roots and shoots.			
Know that gibberellins are important in initiating seed germination.			
Know that ethene controls cell division and ripening of fruits			
Use of plant hormones			
Be able to describe the effects of some plant hormones and the different ways people use them to control plant growth. Plant growth hormones are used in agriculture and horticulture.			
Hormonal coordination in humans			
Human endocrine system			
Be able to describe the principles of hormonal coordination and control by the human endocrine system			
Describe that the endocrine system is composed of glands which secrete chemicals called hormones directly into the bloodstream. The blood carries the hormone to a target organ where it produces an effect.			
Compared to the nervous system the effects are slower but act for longer.			
The pituitary gland in the brain is a 'master gland' which secretes several hormones into the blood in response to body conditions. These hormones in turn act on other glands to stimulate other hormones to be released to bring about effects			
Be able to identify the position of the following on a diagram of the human body: • pituitary gland • pancreas • thyroid • adrenal gland • ovary • testes.			

Control of blood glucose concentration			
Blood glucose concentration is monitored and controlled by the pancreas. If the blood glucose concentration is too high, the pancreas produces the hormone insulin that causes glucose to move from the blood into the cells.			
Be able to explain how insulin controls blood glucose (sugar) levels in the body.			
Describe the causes and effects of Type 1 and Type 2 diabetes and how to treat them			
Be able to extract information and interpret data from graphs that show the effect of insulin in blood glucose levels in both people with diabetes and people without diabetes			
Describe the role of glucagon when blood glucose concentration is too low, which causes glycogen to be converted into glucose and released into the blood.			
Be able to explain how glucagon interacts with insulin in a negative feedback cycle to control blood glucose (sugar) levels in the body.			
Maintaining water and nitrogen balance in the body			
Be able to explain the effect on cells of osmotic changes in body fluids.			
Describe where and how water is lost from the body			
There is no control over water, ion or urea loss by the lungs or skin.			
Excess water, ions and urea are removed via the kidneys in the urine. If body cells loose or gain too much water by osmosis they do not function efficiently			
The digestion of proteins from the diet results in excess amino acids which need to be excreted safely.			
In the liver these amino acids are deaminated to form ammonia. Ammonia is toxic and so it is immediately converted to urea for safe excretion.			
Be able to describe the function of kidneys in maintaining the water balance of the body. The kidneys produce urine by filtration of the blood and selective reabsorption of useful substances such as glucose, some ions and water.			
Be able to translate tables and bar charts of glucose, ions and urea before and after filtration.			
Be able to describe the effect of ADH on the permeability of the kidney tubules.			
The water level in the body is controlled by the hormone ADH which acts on the kidney tubules.			
This is controlled by negative feedback.			
People who suffer from kidney failure may be treated by organ transplant or by using kidney dialysis.			
Know the basic principles of dialysis.			
Be able to explain the roles of thyroxine and adrenaline in the body.			
Hormones in human reproduction			
Describe role of hormones in human reproduction, including the menstrual cycle. During puberty reproductive hormones cause secondary sex characteristics to develop.			
Oestrogen is the main female reproductive hormone produced in the ovary.			

At puberty eggs begin to mature and one is released approximately every 28 days. This is called ovulation.			
Testosterone is the main male reproductive hormone produced by the testes and it stimulates sperm production.			
Be able to explain the interactions of FSH, oestrogen, LH and progesterone, in the control of the menstrual cycle.			
Be able to extract and interpret data from graphs showing hormone levels during the menstrual cycle.			
Be able to evaluate the different hormonal and non-hormonal methods of contraception.			
Be able to explain the use of hormones in modern reproductive technologies to treat infertility.			
Describe In Vitro Fertilisation (IVF) treatment and the advantages and disadvantages of this			
Inheritance, variation and evolution			
Reproduction			
Understand that meiosis leads to non-identical cells being formed while mitosis leads to identical cells being formed.			
Sexual reproduction involves the joining (fusion) of male and female gametes:			
In sexual reproduction there is mixing of genetic information which leads to variety in the offspring. The formation of gametes involves meiosis.			
Asexual reproduction involves only one parent and no fusion of gametes. There is no mixing of genetic information. This leads to genetically identical offspring (clones). Only mitosis is involved.			
Explain how meiosis halves the number of chromosomes in gametes and fertilisation restores the full number of chromosomes.			
Know that when a cell divides to form gametes: • copies of the genetic information are made • the cell divides twice to form four gametes, each with a single set of chromosomes • all gametes are genetically different from each other.			
Gametes join at fertilisation to restore the normal number of chromosomes.			
Describe how the new cell divides by mitosis. The number of cells increases. As the embryo develops cells differentiate.			
Explain the advantages of sexual and asexual reproduction:			
Some organisms reproduce by both methods depending on circumstances.			
DNA and the genome			
Be able to describe the structure of DNA and define genome.			
Know that a gene is a small section of DNA on a chromosome.			
Each gene codes for a particular sequence of amino acids, to make a specific protein.			
Be able to explain that the genome of an organism is the entire genetic material of that organism. The whole human genome has now been studied and this will have great importance for medicine in the future.			
Be able to discuss the importance of understanding the human genome.			
Be able to explain that a sequence of three bases is the code for a particular			

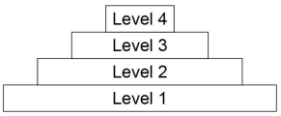
amino acid. The order of bases controls the order in which amino acids are assembled to produce a particular protein.			
Recall a simple description of protein synthesis			
Explain simply how the structure of DNA affects the protein made			
Describe how genetic variants may influence phenotype: a)in coding DNA by altering the activity of a protein: b) in noncoding DNA by altering how genes are expressed.			
(HT only) Be able to explain how a change in DNA structure may result in a change in the protein synthesised by a gene.			
(HT only) Be able to explain when the protein chain is complete it folds up to form a unique shape. This unique shape enables the proteins to do their job as enzymes, hormones or forming structures in the body such as collagen.			
(HT only) Be able to explain mutations occur continuously. Most do not alter the protein, or only alter it slightly so that its appearance or function is not changed.			
(HT only) Be able to explain that a few mutations code for an altered protein with a different shape. An enzyme may no longer fit the substrate binding site or a structural protein may lose its strength.			
(HT only) Describe how not all parts of DNA code for proteins. Non-coding parts of DNA can switch genes on and off, so variations in these areas of DNA may affect how genes are expressed.			
Genetic inheritance			
Be able to explain the terms: gamete, chromosome, gene, allele, dominant, recessive, homozygous, heterozygous, genotype, phenotype.			
Be able to explain some characteristics are controlled by a single gene, such as: fur colour in mice; and red-green colour blindness in humans. Each gene may have different forms called alleles.			
Be able to explain that the alleles present, or genotype, operate at a molecular level to develop characteristics that can be expressed as a phenotype.			
Be able to explain most characteristics are a result of multiple genes interacting, rather than a single gene.			
Be able to understand the concept of probability in predicting the results of a single gene cross, but recall that most phenotype features are the result of multiple genes rather than single gene inheritance.			
Be able to use direct proportion and simple ratios to express the outcome of a genetic cross.			
Be able to complete a Punnett square diagram and extract and interpret information from genetic crosses and family trees. (HT only) Students should be able to construct a genetic cross by Punnett square diagram and use it to make predictions using the theory of probability.			
Some disorders are inherited. These disorders are caused by the inheritance of certain alleles. • Polydactyly • Cystic fibrosis			

Be able to carry out a genetic cross to show sex inheritance.			
Understand and use direct proportion and simple ratios in genetic crosses.			
Variation and evolution			
Be able to describe simply how the genome and its interaction with the environment influence the development of the phenotype of an organism.			
Describe differences in the characteristics of individuals in a population is called variation and may be due to differences in genes and environment			
Recall that all variants arise from mutations and that: most have no effect on the phenotype; some influence phenotype; very few determine phenotype.			
Describe how mutations occur continuously. Very rarely a mutation will lead to a new phenotype.			
Be able to describe evolution as a change in the inherited characteristics of a population over time through a process of natural selection which may result in the formation of a new species.			
The theory of evolution by natural selection states that all species of living things have evolved from simple life forms that first developed more than three billion years ago.			
Be able to explain how evolution occurs through natural selection of variants that give rise to phenotypes best suited to their environment.			
Be able to explain if two populations of one species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.			
Be able to explain the impact of selective breeding of food plants and domesticated animals and has been carried out for thousands of years by humans			
Describe how selective breeding involves choosing parents with the desired characteristic from a mixed population. They are bred together.			
Describe how selective breeding can lead to 'inbreeding' where some breeds are particularly prone to disease or inherited defects			
Genetic engineering			
Be able to describe genetic engineering as a process which involves modifying the genome of an organism by introducing a gene from another organism to give a desired characteristic.			
Examples of genetic engineering include introducing resistance to diseases, producing bigger crops and making bacteria make useful materials such as insulin			
Be able to explain the potential benefits and risks of genetic engineering in agriculture and in medicine and that some people have objections.			
Be able to explain that crops that have had their genes modified in this way are called genetically modified (GM) crops. Some people are concerned about detrimental effects on natural populations of organisms			
Modern medical research is exploring the possibility of genetic modification to overcome some inherited disorders.			
(HT only) Be able to describe the main steps in the process of genetic engineering.			
Explain the methods and role of tissue culture and cuttings, to increase plant			

numbers			
Explain the process of embryo transplant as a means of cloning animals			
Explain adult cell cloning using nuclear transfer			
Theory of evolution			
Darwin published his ideas in On the Origin of Species (1859). There was much controversy surrounding these revolutionary new ideas.			
Explain the reasons why the theory of evolution by natural selection was only gradually accepted			
Describe other theories, including that of Jean-Baptiste Lamarck			
Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection Explain the impact of these ideas on biology.			
Alfred Russel Wallace independently proposed the theory of evolution by natural selection.			
Wallace worked worldwide gathering evidence for evolutionary theory. He is best known for his work on warning colouration in animals and his theory of speciation.			
Alfred Wallace did much pioneering work on speciation but more evidence over time has led to our current understanding of the theory of speciation.			
Be able to describe the steps which give rise to new species.			
Describe the development of our understanding of genetics including the work of Mendel Understand why the importance of Mendel's discovery was not recognised until after his death.			
In the late 19th Century behaviour of chromosomes during cell division was observed.			
In the early 20th Century it was observed that chromosomes and Mendel's 'units' behaved in similar ways. This led to the idea that the 'units', now called genes, were located on chromosomes.			
This scientific work by many scientists led to the gene theory being developed			
Be able to describe the evidence for evolution including fossils and antibiotic resistance in bacteria.			
Explain the evidence for Darwin's theory is now available as it has been shown that characteristics are passed on to offspring in genes.			
Explain that fossils are the 'remains' of organisms from millions of years ago, which are found in rocks.			
Explain how fossils may be formed:			
Explain why fossil record is an incomplete history of the species on earth			
Describe what we can learn from fossils how much or how little different organisms have changed as life developed on Earth.			
Be able to extract and interpret information from charts, graphs and tables such as evolutionary trees.			
Explain why species extinctions occur			
Explain why bacteria can evolve rapidly because they reproduce at a fast rate.			
Explain how mutations of bacterial pathogens produce new strains which can			

develop antibiotic resistance such as MRSA.			
Describe the methods to reduce the rate of development of antibiotic resistant strains: The development of new antibiotics is costly and slow. It is unlikely to keep up with the emergence of new resistant strains.			
Classification of living organisms			
Traditionally living things have been classified into groups depending on their structure and characteristics in a system developed by Carl Linnaeus.			
Linnaeus classified living things into kingdom, phylum, class, order, family, genus and species. Organisms are named by the binomial system of genus and species.			
Be able to use information given to show understanding of the Linnaean system.			
Be able to describe the impact of developments in biology on classification systems.			
Explain how evidence of internal structures became more developed due to improvements in microscopes, and the understanding of biochemical processes progressed, so, new models of classification were proposed.			
Due to evidence available from chemical analysis there is now a 'three-domain system' developed by Carl Woese.			
Evolutionary trees are a method used by scientists to show how they believe organisms are related. They use current classification data for living organisms and fossil data for extinct organisms.			
Adaptations, interdependence and competition			
Be able to describe different levels of organisation in an ecosystem from individual organisms to the whole ecosystem			
Be able to describe the importance of interdependence and competition in a community.			
Suggest the factors for which organisms are competing in a given habitat			
Suggest how organisms are adapted to the conditions in which they live.			
An ecosystem is the interaction of a community of living organisms (biotic) with the non-living (abiotic) parts of their environment			
To survive and reproduce, organisms require a supply of materials from their surroundings and from the other living organisms there.			
Plants in a community or habitat often compete with each other for light and space, and for water and mineral ions from the soil.			
Explain how animals often compete with each other for food, mates and territory.			
Explain how within a community each species is interdependent on the others. A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant			
Be able to extract and interpret information from charts, graphs and tables relating to the interaction of organisms within a community			
Abiotic factors			
Be able to explain what an abiotic factor is and how it would affect a given community given appropriate data or context.			

Biotic factors			
Be able to explain what a biotic factor is and how one might affect a given community given appropriate data or context.			
Be able to extract and interpret information from charts, graphs and tables relating to the effect of biotic factors on organisms within a community.			
Adaptations			
Be able to explain how organisms are adapted to live in their natural environment, given appropriate information.			
Organisms have features (adaptations) that enable them to survive in the conditions in which they normally live. These adaptations may be structural, behavioural or functional			
Explain that some organisms live in environments that are very extreme and these organisms are called extremophiles e.g. bacteria living in deep sea vents			
Organisation of an ecosystem			
Understand that photosynthetic organisms are the producers of biomass for life on Earth.			
Feeding relationships within a community can be represented by food chains.			
A range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem.			
In relation to abundance of organisms students should be able to: • understand the terms mean, mode and median • calculate arithmetic means • plot and draw appropriate graphs selecting appropriate scales for axes.			
Producers are eaten by primary consumers, which in turn may be eaten by secondary consumers and then tertiary consumers.			
Consumers that kill and eat other animals are predators, and those eaten are prey. In a stable community the numbers of predators and prey rise and fall in cycles.			
Be able to interpret graphs used to model these cycles.			
How materials are cycled			
Recall that many different materials cycle through the abiotic and biotic components of an ecosystem			
Explain the importance of the carbon and water cycles to living organisms.			
Explain that all materials in the living world are recycled to provide the building blocks for future organisms			
Describe and explain the events of the carbon cycle.			
Describe and explain the events of the water cycle			
Be able to explain the role of microorganisms in cycling materials through an ecosystem by returning carbon to the atmosphere as carbon dioxide and mineral ions to the soil.			
Decomposition			
Be able to explain how temperature, water and availability of oxygen affect the rate of decay of biological material			
Be able to:			

• calculate rate changes in the decay of biological material • translate information between numerical and graphical form • plot and draw graphs selecting appropriate scales for the axes.			
Explain how gardeners and farmers try to provide optimum conditions for rapid decay of waste biological material. The compost produced is used as a natural fertiliser for growing garden plants or crops.			
Anaerobic decay produces methane gas. Biogas generators can be used to produce methane gas as a fuel.			
Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.			
Impact of environmental change			
Be able to evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information.			
Explain how environmental changes affect the distribution of species in an ecosystem.			
Trophic levels in an ecosystem			
Be able to describe the differences between the trophic levels of organisms within an ecosystem.			
Trophic levels can be represented by numbers, starting at level 1 with plants and algae. Further trophic levels are numbered subsequently according to how far the organism is along the food chain.			
Apex predators are carnivores with no predators.			
How decomposers break down dead plant and animal matter			
Pyramids of biomass can be constructed to represent the relative amount of biomass in level of a food chain. Trophic level 1 is at the bottom of the pyramid.  each			
Be able to construct accurate pyramids of biomass from appropriate data.			
Transfer of biomass			
Describe pyramids of biomass Explain how biomass is lost between the different trophic levels.			
Producers are mostly plants and algae which transfer about 1% of the incident energy from light for photosynthesis			
Explain why only approximately 10% of the biomass from each trophic level is transferred to the level above it.			
Be able to calculate the efficiency of biomass transfers between trophic levels by percentages or fractions of mass.			
Be able to explain how this affects the number of organisms at each trophic level.			
Biodiversity and the effect of human interaction on ecosystems			
Biodiversity is the variety of all the different species of organisms on earth, or within an ecosystem.			
A great biodiversity ensures the stability of ecosystems by reducing the dependence of one species on another for food, shelter and the maintenance of the physical environment.			

The future of the human species on Earth relies on us maintaining a good level of biodiversity. Many human activities are reducing and only recently have measures been taken to try to stop this reduction.			
Explain how rapid growth in the human population and an increase in the standard of living mean that increasingly more resources are used and more waste is produced.			
Causes of pollution			
Explain how humans reduce the amount of land available for other animals and plants by building, quarrying, farming and dumping waste.			
The impact of the destruction of peat bogs			
Large-scale deforestation in tropical areas has occurred to: • provide land for cattle and rice fields • grow crops for biofuels			
Students should be able to describe some of the biological consequences of global warming..			
Be able to describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity.			
Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on ecosystems and biodiversity.			
Factors affecting food security			
Describe some of the biological factors affecting levels of food security. Food security is having enough food to feed a population.			
Sustainable methods must be found to feed all people on Earth.			
Farming techniques			
Explain how the efficiency of food production can be improved by restricting energy transfer from food animals to the environment.			
Explain that fish stocks in the oceans are declining.			
Describe important methods to maintain fish stocks at a level where breeding continues or certain species may disappear altogether in some areas.			
Be able to describe and explain some possible biotechnical and agricultural solutions, including genetic modification, to the demands of the growing human population.			
Modern biotechnology techniques enable large quantities of microorganisms to be cultured for food.			
The fungus Fusarium is useful for producing mycoprotein, a protein rich food suitable for vegetarians.			
A genetically modified bacterium produces human insulin. When harvested and purified this is used to treat people with diabetes.			
GM crops could provide more food or food with an improved nutritional value such as golden rice.			

Required Practicals

	Activity
1	Use a light microscope to observe, draw and label a selection of plant and animal cells
2	Investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition.
3	Investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue.
4	Use qualitative reagents to test for a range of carbohydrates, lipids and proteins. To include: Benedict's test for sugars; iodine test for starch; and Biuret reagent for protein.
5	Investigate the effect of pH on the rate of reaction of amylase enzyme
6	Investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed.
7	Plan and carry out an investigation into the effect of a factor on human reaction time.
8	Investigate the effect of light or gravity on the growth of newly germinated seedlings.
9	Measure the population size of a common species in a habitat. Use sampling techniques to investigate the effect of a factor on the distribution of this species
10	Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change.