The Sutton Academy

Knowledge Rich Curriculum Plan

Science – Biology Year 11

Genetics

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
DNA Structure ,discovery and the genome project Triple Only	*-Students will know that DNA is the genetic material found in the nucleus of animal and plant cells and has a double helix structure. This means two strands twisted around each other. DNA is a polymer which means it is a long chain of repeating units. Students will know that in eukaryotic cell's DNA forms thread like structures called chromosomes. Body cells contains chromosomes in pairs because we inherit one chromosome from each parent. These pairs are called homologous pairs. Students will know that chromosomes contain small sections called genes which code for particular characteristics. The genome is the full genetic makeup of an organism.* *-Students will know how to label a diagram of DNA including the bases, sugar phosphate backbone and nucleotide.* *-Students will know that James Watson and Francis Crick developed the idea that DNA has a double helix structure and won a Nobel Prize. Watson and Crick used stick-and-ball models to test their ideas on the possible structure of DNA. Other scientists used experimental methods instead. Among them were Rosalind Franklin and Maurice Wilkins, who were using X-ray diffraction to understand the physical structure of the DNA molecule.*	- *Students need to already know that the male gamete is the sperm cell and the female gamete is the egg cell.* - *Students will know that the job of the sperm cell is to swim towards the egg cell and is adapted to do this by having a tail (flagellum), mitochondria and acrosome (enzyme). When the sperm fuses with the egg cell this is known as fertilisation.* - *Students will know that DNA is in the nucleus of eukaryotic cells but prokaryotic cells have plasmids, which are rings of DNA, in the cytoplasm.* - *Students should know that variation is defined as differences between living things and can be a result of inheritance or the environment.* - *Students need to already know how that some animals and plants are endangered which means their numbers are at a critically low level. Extinction means the animals or plants no longer exist.*	*-Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.* *-Understand how scientific methods and theories develop over time.*	*Gene* *Chromosome* *DNA* *Mitochondria* *Nucleus* *Double Helix* *Human Genome* *Allele* *Homologous pairs*	https://www.bbc.co.uk/bitesize/guides/zycmk2p/revision/3
Cell Cycle	Students will know that the nucleus of a cell contains chromosomes which are made of DNA molecules. Genes are sections on the chromosomes which carry genetic information. Chromosomes are found in pairs in the nucleus of cells because we inherit half	*Students need to already know that DNA is found in the nucleus of cells and that we inherit genes from our parents.* *Students will label where the nucleus, cell membrane and cytoplasm are in a diagram.* - *Students will know that multicellular organisms are made up of more than 1 cell*		Cell cycle Mitosis Meiosis Chromosomes Cytokinesis Continually Replicate	https://www.bbc.co.uk/bitesize/guides/z3qjcj6/revision/2#:~:text=A%20growing%20and%20dividing%20cell,of%20cell%20division%20called%20mitosis%20.

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	from each parent. Human body cells contain 46 chromosomes or 23 pairs. Students will know that the cell cycle is a series of stages a cell goes through when it is growing and dividing to allow growth and repair of an organism. During the first stage of the cell cycle, the cell grows and the DNA replicates (makes a copy of itself) to for 2 copies of each chromosome. A process called mitosis then occurs (DETAILS OF STAGES NOT NEEDED BUT ANIMATION MAY HELP STUDENTS TO VISUALISE) where one set of chromosomes is pulled to each end of the cell and the nucleus divides. Finally, the cytoplasm and cell membrane divides to for 2 genetical identical cells called daughter cells. Students will be able to recognise and describe situations where mitosis is occurring.	*(unicellular) and that cells don't just grow in size when we grow, cells divide to make more which results in growth.*			
Mitosis and meiosis	*-Students will be able to explain how meiosis halves the number of chromosomes and fertilisation restores the full number of chromosomes.* *-Students will know that cells in reproductive organs divide by meiosis to form gametes.* *Students will 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.* *-Students will know that when the gametes join at fertilisation to restore the normal number of chromosomes. The new cell divides by mitosis. The number of cells increases. As the embryo develops cells differentiate.*	*-Students should already know that egg and sperm cells are genetically different.* *-Students should already know that mitosis produces genetically identical cells and this type of cell division is used for growth, repair and replacement in all body cells apart from the sex cells.* -	*-Modelling behaviour of chromosomes during meiosis.*	*Mitosis* *Meiosis* *Gamete*	*https://www.bbc.co.uk/bitesize/guides/zycmk2p/revision/2*
Sexual and Asexual reproduction	*-Students will know that meiosis leads to non-identical cells* *being formed while mitosis leads to identical cells being formed.*	- *Students should already know that animal sex cells are egg and sperm cells and flowering plant sex cells are pollen and egg cells.*		*Fertilisation* *Fusion* *Reproduction* *Zygote*	*https://www.bbc.co.uk/bitesize/guides/zycmk2p/revision/1*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	-Students will know that Sexual reproduction involves the joining (fusion) of male and female gametes: *-Students will know that In sexual reproduction there is mixing of genetic information which leads to variety in the offspring. The formation of gametes involves meiosis.* *-Students will know that 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.*	- *Students should already know that plants can reproduce both asexually and sexually.* - *Students should already know that egg and sperm cells are genetically different.*		*Variation*	
Punnett Squares	*-Students will know that 22 pairs of chromosomes control body characteristics and pair 23 determines the biological sex of the offspring. Female sex chromosomes are XX and male chromosomes are XY.* *-Students will know how to complete a punnet square to prove there is a 50:50 chance of having a male or female offspring.* *-Students will know that most characteristics are a result of multiple genes however some characteristics are controlled by a single gene e.g fur colour.* *-Students will know that genes can have different forms called alleles and the alleles which are present form the genotype.* *-Students will know that if their genotype consists of two alleles the same then this is homozygous however, if their genotype consists of two different alleles then this is heterozygous.* *-Students will know that the characteristic expressed as a result of their genotype is called the phenotype.*	*-Students will have learnt that probability can be written as a ratio, and percentage.* *-Students should know that humans have sex chromosomes Female is XX and male is XY.* *-Students should already know that a punnet square is a square diagram that is used to predict the genotypes of a particular cross or breeding experiment.* *-Students should already know that an allele is a different version of the same gene.*	*-Use a variety of models such as representational, spatial, descriptive,* *-Computational and mathematical to solve problems, make predictions and to develop scientific explanations and understanding of familiar and unfamiliar facts.*	*dominant* *recessive* *homozygous* *heterozygous* *genotype* *phenotype.*	*https://www.bbc.co.uk/bitesize/guides/zcdfmsg/revision/1*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	-Students will know that alleles can be dominant or recessive. A recessive allele is only expressed if the genotype is homozygous recessive (2 recessive alleles). A dominant allele is always expressed even if only one copy is present. *-Students will know how to complete a monohybrid cross/ punnet square and form conclusion based on simple ratio. Students will be able to interpret family trees. (HIGHER ONLY construct own)*				
Punnett Squares and Genetic Disorders	*-Students will know that polydactyly is a genetic disorder which means it is inherited and is characterised by having extra fingers or toes.* *-Students should know that Polydactyly is carried on a dominant allele and students will be able to complete a punnet square to predict the phenotype of the offspring.* *-Students will know that Cystic fibrosis is a genetic disorder that affects cell membranes and is characterised by the production of excess mucus in the breathing system and digestive system. Cystic fibrosis is carried on the recessive allele and students will be able to complete a punnet square to predict the phenotype of the offspring.* *-Students will know how to make informed judgements about economic, social and ethical issues around embryo screening. For example, Economical- expensive, social- choice, ethical- religion/attitude to termination.*	*-Students should know that diseases can be inherited from their parents.* *-Students should already know that an allele is a different version of the same gene.* *-Students should know how to carry out/analyse a genetic cross and family tree to determine the phenotype and genotype of the organism.*	*-Appreciate that embryo screening and gene therapy may alleviate suffering but consider the ethical issues which arise.*	*Polydactyly* *Cystic fibrosis* *Inherited* *Disorder*	*https://www.bbc.co.uk/bitesize/guides/zcdfmsg/revision/6*
Selective Breeding	*-Students will know how to explain the impact of selective breeding of food plants and domesticated animals.* *-Students will know that Selective breeding (artificial selection) is the process by which humans breed plants and animals for particular genetic characteristics.*	*Students should recall that there is variation between members of the same species.* *- Students should know that humans breed plants and animals for their desired characteristics e.g. for crop size and to make pleasant pets and good looking animals.* *-Students should already know that inbreeding is when organisms reproduce with siblings or close*	*Explain the benefits and risks of selective breeding given appropriate information and consider related ethical issues.*	*Breeding* *Selective* *Characteristics* *Resistance* *Classification* *Mutation* *Inbreeding.*	https://www.bbc.co.uk/bitesize/guides/z3qjcj6/revision/2#:~:text=A%20growing%20and%20dividing%20cell,of%20cell%20division%20called%20mitosis%20.

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	-Students will know that humans have been doing this for thousands of years since they first bred food crops from wild plants and domesticated animals. *Students will learn that the process of selective breeding is: 1.choosing parents with the desired characteristic from a mixed population. 2.Breeding them together.3. offspring those with the desired characteristic are bred together. 4. continue over many generations until all the offspring show the desired characteristic.* *Students should know that the characteristic can be chosen for:* *-Usefulness or appearance:* *-Disease resistance in food crops.* *- Animals which produce more meat or milk.* *- Domestic dogs with a gentle nature.* *- Large or unusual flowers.* *-Students will know that selective breeding can lead to 'inbreeding' where some breeds are particularly prone to disease or inherited defects.* *-Students will know how to explain the impact of selective breeding of food plants and domesticated animals.*	*relatives, this can then cause the offspring to be more prone to disease and inherited disorders*			
Genetic engineering	*-Students will learn that genetic engineering is a process.* *which involves modifying the genome of an organism by introducing a* *gene from another organism to give a desired characteristic.* *-Students will learn that Plant crops have been genetically engineered to be resistant to diseases or to produce bigger better fruits.* *Students will learn that bacterial cells have been genetically engineered to produce useful* *substances such as human insulin to treat diabetes.*	*-Students should already know that a gene is a section of DNA responsible for characteristics.* *-Students should already know that genes can be inserted into other organisms to give the desired characteristic.* *-Students should know that plants can be genetically modified to produce a larger yield.*	*-Appreciate the power and limitations of* *science and consider any ethical issues* *which may arise.* *-HT only interpret information about genetic engineering techniques and to make informed judgements about issues concerning cloning and genetic engineering, including GM crops.*	*Genetically modified* *Plasmid* *Isolate* *Replicate* *Yield*	*https://www.bbc.co.uk/bitesize/guides/zsswqdm/revision/4*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	-Students will be able to explain the potential benefits and risks of genetic engineering in agriculture and in medicine and that some people have objections to this. *-Students will learn that in genetic engineering, genes from the chromosomes of humans and other organisms can be 'cut out' and transferred to cells of other organisms and that when crops have had their genes modified in this way they are called genetically modified (GM) crops.* *-Students will learn that GM crops include ones that are* *-resistant to insect attack or to herbicides. -GM crops generally show increased yields.* *-Students will learn that there are some concerns regarding GM crops and this includes the effect on populations of wild flowers and insects and some people feel the effects of eating GM crops on human health have not been fully explored.* *-Students will learn that modern medical research is exploring the possibility of genetic modification to overcome some inherited disorders.* *- (HT only) Students will be able to describe the main steps in the process of genetic engineering.* *-(HT only) students will learn that genetic engineering is when:* *1. enzymes are used to isolate the required gene; this gene is inserted into a vector, usually a bacterial plasmid or a virus* *2. the vector is used to insert the gene into the required cells* *3. genes are transferred to the cells of animals, plants or*				

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	microorganisms at an early stage in their development so that they develop with desired characteristics.				
Variation and evolution by natural selection	*-Students will know that differences in the characteristics of individuals in a population is called variation and may be due to differences in: the genes they have inherited (genetic causes), the conditions in which they have developed (environmental causes), a combination of genes and the environment.* *-Students will know mutations occur continuously and cause variations. Very rarely a mutation will lead to a new phenotype. If the new phenotype is suited to an environmental change it can lead to a relatively rapid change in the species.* *-Students will learn that there is usually extensive genetic variation within a population of a species.* *-Students will know 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.* *-Students will learn that 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.* *-Students will know how to explain how evolution occurs through natural selection (as devised by Charles Darwin) of variants that give rise to phenotypes best suited to their environment species become so different in phenotype that they can no longer interbreed to produce fertile offspring they have formed two new species.* *-Students will know that the evidence for evolution including fossils. And that the*	*-Students should already know that variation is the difference in characteristics of each species.* *-Students will already know the difference between continuous and discontinuous variation: Continuous: any value. Discontinuous: categorical and they can give example of each.* *- Students will know that Charles Darwin came up with the theory of Evolution and natural selection.* *-Students will know that variation can be caused by both genetics and environmental factors.* *-Students will recall fossil formation from Ks3 and that fossils can only be found in sedimentary rocks.*	*-Students should be able to extract and interpret information from charts, graphs and tables such as evolutionary trees.* *-Students will know how to extract and interpret information from charts, graphs and tables re fossil record.*	*Continuous variation* *Discontinuous variation* *Genetic variation* *Environmental variation.* *Fossils* *Evolution* *Natural selection*	*https://www.bbc.co.uk/bitesize/topics/zppffcw*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	theory of evolution by natural selection is now widely accepted. *Evidence for Darwin's theory is now available as it has been shown that characteristics are passed on to offspring in genes. There is further evidence in the fossil record FOSSILS - Fossils are the 'remains' of organisms from millions of years ago, which are found in rocks.* *-Students will know that Fossils may be formed: from parts of organisms that have not decayed because one or more of the conditions needed for decay are absent, - when parts of the organism are replaced by minerals as they decay.* *-As preserved traces of organisms, such as footprints, burrows and rootlet traces.* *-Many early forms of life were soft-bodied, which means that they have left few traces behind. What traces there were have been mainly destroyed by geological activity. This is why scientists cannot be certain about how life began on Earth.* *-We can learn from fossils how much or how little different organisms have changed as life developed on Earth.*				
Antibiotic resistance	*-Students will learn that bacteria can evolve rapidly because they reproduce at a fast rate.* *-Students will learn that mutations of bacterial pathogens produce new strains and some strains might be resistant to antibiotics, and so are not killed. They survive and reproduce, so the population of the resistant strain rises. The resistant strain will then spread because people are not immune to it and there is no effective treatment.* *-MRSA is resistant to antibiotics.* *-To reduce the rate of development of antibiotic resistant strains:*	*- Students should already know the difference between antibiotics and analgesics (painkillers).* *-Students should already know that bacteria multiply at a fast rate and through a process known as binary fission.* *-Students should already know that antibiotics are only used to treat bacterial infections.* *-Students should already know that it is the bacteria that become resistant to antibiotics and not the organism.* *-Students should already know that different types of antibiotics can be used to treat different species of bacteria.*	*-Explain everyday and technological applications of science; evaluate associated personal, social, economic and environmental implications; and make decisions based on the evaluation of evidence and arguments.*	*Resistance* *Antibiotics* *Strain* *Agricultural use*	*https://www.bbc.co.uk/bitesize/guides/z2fqcj6/revision/4*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	1. Doctors should not prescribe antibiotics inappropriately, such as treating non-serious or viral infections *2. Patients should complete their course of antibiotics so all bacteria are killed and none survive to mutate and form resistant strains* *3. The agricultural use of antibiotics should be restricted.* *4.The development of new antibiotics is costly and slow. It is unlikely to keep up with the emergence of new resistant strains.*	*-Students should already know that doctors need to prescribe antibiotics and they cannot be bought over the counter.*			
TRIPLE ONLY ***Cloning***	*-Students should learn that tissue culture is when we use small groups of cells from part of a plant to grow identical new plants. This is important for preserving rare plant species or commercially in nurseries.* *-Students should learn that cuttings are an older, but simpler, method used by gardeners to produce many identical new plants from a parent plant.* *-Students should learn that embryo transplants are when cells from a developing animal embryo are split apart before they become specialised, we then transplant the identical embryos into host mothers.* *-Students should learn that Adult cell cloning is when the nucleus is removed from an unfertilised egg cell then the nucleus from an adult body cell, such as a skin cell, is inserted into the egg cell. Then an electric shock stimulates the egg cell to divide to form an embryo.* *These embryo cells contain the same genetic information as the adult skin cell.* *Then the embryo has developed into a ball of cells, it is inserted into the womb of an adult female to continue its development.*	*-Students should know clones are genetically identical individuals.* *- Students should know that organisms can be manipulated to produce clones for beneficial reasons. E.g. for agriculture, preserving rare plant species.* *-Students should know that the genetic information of animals and plants are found in the nucleus of their cells.* *-Students should already know that agar jelly is used to grow mainly microorganisms and it contains nutrients and space for the organism to grow.* *-Students should recall that auxins are plant hormones that control growth.* *-Students should be familiar with dolly sheep who was the first mammal cloned in 1996 she later died in 2003.*	*-Explain the potential benefits and risks of cloning in agriculture and in medicine and that some people have ethical objections.*	Cloning Tissue culture Cuttings Embryo Zygote Transplant Nurseries In vitro **Micropropagation** Explants	https://www.bbc.co.uk/bitesize/guides/zsq6v9q/revision/9 https://www.bbc.co.uk/bitesize/guides/zsq6v9q/revision/8

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
TRIPLE ONLY Speciation	*Students should be able to:* *1.Describe the work of Darwin and Wallace in the development of the theory of evolution by natural selection* *2.Explain the impact of these ideas on biology.* *-Students should learn that Alfred Russel Wallace independently proposed the theory of evolution by natural selection. He published joint writings with Darwin in 1858 which prompted Darwin to publish On the Origin of Species (1859) the following year.* *-Students should learn that Wallace worked worldwide gathering evidence for evolutionary theory and that he is best known for his work on warning colouration in animals and his theory of speciation.* *-Students should learn that Alfred Wallace did much pioneering work on speciation but more evidence over time has led to our current understanding of the theory of speciation.* *-Students should be able to describe the steps which give rise to new species.*	*-Students should know that the theory of evolution and natural selection was developed by Charles Darwin.* *- Students should know that Evolution is the change of inherited characteristics within a population over time through natural selection, which may result in the formation of a new species.* *-Students should know that Natural selection is when populations of living organisms adapt and change in accordance to their environment which enables them to survive.* *-Students should be familiar with Charles Darwins trip to the Galapagos islands and his study of the finches on different islands.*	*-The theory of speciation has developed over time.*	*Speciation* *Species* *Theory* *Isolation*	*https://www.bbc.co.uk/bitesize/guides/zcqbdxs/revision/6*
Triple ONLY Protein Synthesis	*Students will learn that DNA contains the genetic code that determines the order of amino acids in a protein. A gene is a section of DNA that codes for a Protein.* *Students will learn that 3 bases code for 1 amino acid. The order of amino acids determines the protein's shape and function.* *Mutations in DNA can lead to changes in amino acid sequence, potentially affecting protein function.* *Students will learn Mutations occur continuously and often randomly. Most do not alter the protein, or only alter it slightly so that appearance or function is not changed.*	*Students should be able to describe the structure of DNA. They should know that proteins are made from amino acids.*		*Proetinsynthesesis*	

The Sutton Academy

Knowledge Rich Curriculum Plan

Science – Biology Year 11

Homeostasis

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
Endocrine system	*Students will learn that hormones are chemicals that are secreted by glands and travel through the blood stream to a target organ. Students will know that a nervous response is an electrical impulse, fast acting but short lasting. A hormonal response is a chemical message which is slow acting but long lasting (exception- adrenaline)* *Students will be able to name, locate and state the action of the following glands:* *Pituitary (Master gland as it secretes several hormones) LH, FSH (Triple introduce ADH)* *Pancreas- Secretes insulin or glucagon in blood glucose regulation* *Thyroid- Secretes thyroxine which is involved in metabolism* *Adrenal glands – secrete adrenaline and causes heart rate to increase* *Ovaries- Produce oestrogen and progesterone which are hormones involved in the menstrual cycle* *Testes-Produce testosterone involved in sperm production*	*Students will know that salivary glands secrete saliva in the mouth* *Students may have experienced the effect of adrenaline and the fight or flight response.*		***Hormone*** ***Gland*** ***Target organ*** ***Pituitary***	*https://www.bbc.co.uk/bitesize/guides/zq4mk2p/revision/1* *https://www.bbc.co.uk/bitesize/guides/zprxy4j/revision/5*
Blood sugar control (Too high)	*Students will know that the pancreas is an organ that monitors and controls blood glucose levels.* *Blood glucose levels increase following a meal. This increase in blood glucose is detected by the pancreas and the hormone insulin is released into the blood stream. Insulin is detected by the receptors on the liver which will convert the excess glucose into glycogen to be stored. Muscle cells also take in glucose and covert it to glycogen for storage.*	*Students will already know that diabetes is a non communicable disease. They will know that sufferers of diabetes have problems controlling there blood sugar levels and often need injections to manage the condition*		*Insulin* *Glycogen* *Glucose* *Receptors* *Convert* *Non-communicable*	*https://www.bbc.co.uk/bitesize/guides/zq4mk2p/revision/4*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	Insulin is a hormone which causes more glucose to move into the cells.				
Blood sugar control (too low) HIGHER ONLY	*Blood glucose levels decrease during periods of fasting or during exercise as the body uses glucose for respiration.* *When blood glucose levels fall too low, the pancreas releases glucagon into the bloodstream. The glucagon is detected by the liver which then releases stored glycogen as glucose to increase blood glucose levels again.* *Blood sugar regulation is an example of a negative feedback mechanism. A negative feedback control system responds when conditions change from the ideal or set point and returns conditions to this set point. There is a continuous cycle of events in negative feedback.* *if the level of something rises, control systems reduce it again* *if the level of something falls, control systems raise it again*	*Students will already know that diabetes is a non communicable disease. They will know that sufferers of diabetes have problems controlling there blood sugar levels and often need injections to manage the condition* *Respiration in a chemical reaction that happens in the mitochondria and requires glucose.*	*Interpreting a negative feedback graph*	*Respiration* *Glucagon* *Negative feedback*	*https://www.bbc.co.uk/bitesize/guides/zq4mk2p/revision/4* *https://www.bbc.co.uk/bitesize/guides/zq4mk2p/revision/6*
Diabetes	*Type 1 diabetes is a disorder in which the pancreas doesn't produce insulin. It is treated using insulin injections. Insulin is a protein and so cannot be given in tablet form as it would be digested by enzymes in the digestive system.* *Type 2 diabetes is where the receptors on the liver no longer respond to the insulin produced by the pancreas. A carbohydrate controlled diet and exercise regime are used to control blood sugar levels to avoid peaks and lows. Obesity is a risk factor for type 2 diabetes*	*Students will already know that diabetes is a non communicable disease. They will know that sufferers of diabetes have problems controlling there blood sugar levels and often need injections to manage the condition* *Respiration in a chemical reaction that happens in the mitochondria and requires glucose.*	*WS 1.3 Evaluate information around the relationship between obesity and diabetes.* *Comparing data showing the effect of insulin in a diabetic compared to non diabetic*	*Risk Factor* *Regime*	*https://www.bbc.co.uk/bitesize/guides/zq4mk2p/revision/5*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
Menstrual Cycle	*Students will learn that the 4 main hormones involved in the menstrual cycle are:* *FSH (Follicle stimulating hormone) made in pituitary gland, stimulates eggs to mature* *LH (Luteinising Hormone) made in the pituitary, stimulates ovulation* *Oestrogen- made in the ovaries, causes the uterus to develop* *Progesterone- made in the ovaries, maintains the uterus.* *HIGHER ONLY-* *As above plus* *FSH stimulate oestrogen* *Oestrogen inhibits FSH, stimulates LH*	*Students should already know from KS3 that the menstrual cycle (they will refer to periods) is a recurring process that takes place in a females body. The cycle lasts around 28 days.* *Students should already know that day 14 is when ovulation occurs and if an egg gets fertilized at this time then the lady can become pregnant. One of the first signs of pregnancy is that periods stop.*	*Higher only* *Interpreting graphs relating to hormone levels.*	*Ovulation* *Uterus* *Inhibit*	*https://www.bbc.co.uk/bitesize/guides/zt2yxfr/revision/1*
Contraceptives HIGHER ONLY Infertility and IVF	*Students will learn that there are hormonal contraceptives (contain hormones) and non hormonal (do not contain hormones* *Hormonal methods include- Oral contraceptive pill (contains hormones to inhibit FSH production so no eggs mature) contraceptive implant injections or skin patches,(slow release of progesterone to inhibit maturation of the eggs) intrauterine devices (prevent the implantation of an embryo)* *Non hormonal methods include- Barrier methods Condoms & diaphragms which prevent the sperm from reaching the egg. Sterilization (surgical method), Spermicides (chemicals that kill sperm), abstaining from sexual intercourse* *Fertility is the ability to conceive children* *HIGHER ONLY* *Some people have fertility issues and find it difficult to conceive naturally.*	*Students will already know that contraceptives are used to prevent unwanted pregnancy and condoms are a contraceptive that can reduce the transmission of STIs* *Hormones are chemicals released from a gland which travel through the blood to a target organ*	*Evaluating the various contraceptives* *Understanding how developments in microscopes have led to improved treatment*	*Contraceptives* *Hormonal* *Non Hormonal* *Barrier* *Fertility* *Conceive* *Inhibit* *Mature* *IVF (In Vitro Fertilization)*	*https://www.bbc.co.uk/bitesize/guides/zt2yxfr/revision/3* *https://www.bbc.co.uk/bitesize/guides/zt2yxfr/revision/5*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	FSH & LH are 2 hormones given to women as fertility drugs. She may then be able to become pregnant naturally *IVF (In vitro fertilization)* *FSH & LH given to woman to stimulate eggs to mature and stimulate ovulation* *Eggs collected and fertilized with sperm in a dish* *Fertilized eggs develop into embryos* *One or two of these tiny balls of cells are then inserted into uterus.* *Students should consider pros & cons:* *Pros- Have a child they wouldn't otherwise be able to have* *Cons- Emotional physically and emotionally* *Success rate not very high* *Multiple births which are a risk to babies and mother.*		*Considering Social and ethical issues* *Evaluate fertility methods*		
TRIPLE ONLY Body temperature control	*Students will learn that body temperature is monitored and controlled by the thermoregulatory centre in the brain. The skin contains temperature receptors which detect changes in temperature and send electrical impulses to the thermoregulatory centre.* *Students will learn that when a change in core body temperature is detected, certain mechanisms come into action to maintain the temperature of 37oC* *Too Hot-* *Vasodilation (blood vessels dilate to allow more blood to flow closer to the surface of the skin so more heat is lost by radiation) this causes us to look red* *Increased sweating. When sweat evaporates from the body taking heat energy with it.* *Often we feel thirsty because more water loss results in the blood becoming more concentrated which then stimulates the*	*Students should already know that core body temperature is 37oC. They may know that hypothermia is a condition which can result from prolonged exposure to extreme cold environments* *Students will know that you get goose bumps when you get cold and that you shiver.* *Students will know that when you are hot, you look red and sweat more.*		*Vasodilation* *Vasoconstriction* *Deviation* *Dilate* *Constrict*	*https://www.bbc.co.uk/bitesize/guides/z4khvcw/revision/2* *https://www.youtube.com/watch?v=LAO-ZBv_3J8* *https://www.youtube.com/watch?v=IGsQi0JZUTw*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	hypothalamus in the brain to respond (Link to brain and osmoregulation in future lesson) ***Too Cold-*** *Vasoconstriction (blood vessels constrict so less blood flow near the surface of the skin so less heat lost by radiation) this causes us to look pale* *Sweating stops* *Shivering generates heat energy when muscles contract. 'Goose bumps' appear when hairs stand on end to trap a warm layer of air.*				
TRIPLE ONLY **Kidneys**	*Students will learnt that urine contains water, urea, and ions which are filtered out of the blood by the kidneys* *HIGHER ONLY- Excess proteins-> amino acids which need to be excreted safely. The liver converts these excess amino acids onto ammonia which is toxic and so is converted to urea for safe excretion.* *Students will learn that water balance is controlled by the kidneys which produce urine by filtration of the blood and selective reabsorption of ALL glucose, SOME ions, some water.* *Students will learn the main parts of the nephron (glomerulus- high pressure filtration) convoluted tubule and loop of Henle (selective reabsorption) and the collecting duct (water reabsorption)* Students should be able to translate tables and bar charts of glucose, ions and urea before and after filtration. *HIGHER ONLY-* *Students will describe that when the hypothalamus is the brain detects a decrease in water concentration (more concentrated plasma) , the hormone ADH (anti diuretic hormone) is released from the pituitary gland*	*Students should already know that osmosis is the movement of water from a high concentration of water to a low concentration of water across a selectively permeable membrane.* *Students should already know that if too much water moves into animal cells (hypotonic solution), the cells burst (lysis) if too much water moves out of cells (hypertonic solution) then crenation can occur. Water balance is important to enable cells to function correctly.* *Students should already know that water is lost from the body through sweating, exhaling, urine production*	***MS 4a*** *translate information between numerical and graphical form.*	*Hypertonic* *Hypotonic* *Osmosis* *Antidiuretic* *Negative feedback* *Reabsorption* *Permeability*	*https://www.bbc.co.uk/bitesize/guides/zj7v4wx/revision/4*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	which makes the collecting duct walls more permeable so more water is reabsorbed back into the blood. *Dilute blood plasma would result in no ADH being released and so less reabsorption and more urine production.* *This is an example of a negative feedback mechanism*				
TRIPLE ONLY Dialysis	*Students will learn that dialysis is a process which involves a patient being attached to a machine for several hours, a few times a week whilst the machine filters their blood and removes the urea. This can keep them alive whilst they wait for a donor.* *The patients blood enters the dialysis machine. Inside the machine the blood and dialysis fluid are separated by a partially permeable membrane. The blood flows in the opposite direction to the fluid allowing a concentration gradient to be maintained so exchange of substances continues. Dialysis fluid contains the same concentration of glucose as the blood, the same concentration as mineral ions, no urea. Since there is no urea, there is a large concentration gradient and so urea moves out of the blood by diffusion. (Kay science model)* *Advantages- Reduces urea levels* *Keeps patient alive until a transplant is available* *Disadvantages- Expensive machinery and energy costs. 4-6 hours a week spend attached to a machine 2 or 3 times a week, controlled diet between sessions, damage to veins from inserting canular.* *In order to ensure a transplant is successful, tissue typing is carried out and immunosuppressants are given to reduce the chance of rejection. (Negative- more at risk of infections)* *Advantages of transplants-*	*Students will know that when an organ isn't functioning properly in the body, a transplant is an option which is where an organ is donated by another person. Often the donated organ comes from a relative as it has to 'match'* *Students should know that white blood cells defend the body against foreign antigens. These are found on the surface of organs and if not correctly matched, rejection can occur.* *Students will know that the movement of particles down a concertation gradient is diffusion.*	*WS 1.4 Describing how dialysis works* *WS 1.5 Evaluating the advantages and disadvantages of various organ failure treatments including mechanical devices*		*https://www.youtube.com/watch?v=zg1GZ0kj878* *https://www.youtube.com/watch?v=bfGCBBPuNs8*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	Patients can live normal life *Overall cheaper* *Disadvantage- Invasive surgery, immunosuppressants for life, shortage of donors.* *Transplant only lasts 8-9 years*				
TRIPLE ONLY Plant hormones	*Students will learn that plants produce hormones that control growth.* *Auxins are a group of hormones that are found in the tips of shoots and in the roots.* *Hormones move to different parts of the plants by diffusion.* *Auxins promote cell division which causes cell elongation.* *In the stem auxin promotes growth and in the roots cells grow less* *Phototropism is a response to sunlight. Shoots are positively phototropic and roots are negatively geotropic. When the sun shines on the plant from one side, the auxin moves to the shaded side and causes cell elongation. This causes the shoot to* ***GROW*** *(NOT BEND) towards the sunlight. If sun is directly above the shoot, the shoot will grow upright. If the tip is removes, the auxin is removed and so no growth.* *Geotropism is a response to gravity. Shoots are negatively geotropic and roots are positively geotropic.* ***HIGHER ONLY*** *Students will know that Gibberellins are important for Germination (end seed dormancy, promote flowering, increase fruit size), Ethene controls cell division and ripening of fruit.* *Auxins are used as weedkillers, rooting powders, and growth of tissue culture.* ***REQUIRED PRACTICAL*** *Investigating the effect of light or gravity on germination of seeds*	*Students will know that plant shoots grow towards sunlight and roots grow down into the ground to absorb water and minerals from the soil* *Students may know that rooting powder is used to promote growth of roots*	*AT1- Use appropriate apparatus to record length and time* *AT3- Selecting appropriate apparatus and techniques to measure growth* *AT4- Safe and ethical use of plants* *AT7- Observations of biological specimens to produce scientific drawings* *W2.2 Plan experiments* *W2.6 Make and record observations* *W2.7 Suggest improvements (evaluate method)* *WS 3.1 Present observations as tables, graphs or drawings* *WS 1.3, 1.4 Understand the impact of weedkillers on Biodiversity*	*Elongation* *Auxin* *Agriculture* *Horticulture* *Biodiversity* *Dormancy*	*https://www.bbc.co.uk/bitesize/guides/zc6cqhv/revision/1*

The Sutton Academy

Knowledge Rich Curriculum Plan

Science – Biology Year 11

Sustainability

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
Review of Key content and key literacy	Students will know that... • Ecology is a branch of biology that deals with the relationships that organisms have with one another and their physical surroundings. • They will recognise that a habitat is a natural home or environment of an animal or plant or another organism. Community is a group of species that occurs at the same time in the same place. Population is made up of all the members of a species. And that an ecosystem is characteristic set of plants, animals and microbes. A Niche describes the role an organism plays in a community. A Niche encompasses both the physical and environmental conditions it requires. Biotic factors is a living organism that shapes an environment e.g. New predators, Pathogens, food availability. one species outcompeting another so the numbers are sufficient to breed. Abiotic factors are non living physical conditions. E.g. Temperature, light intensity, Soil pH, mineral content, wind intensity, carbon dioxide levels and oxygen levels for aquatic animals.	• *Students will know that arrows on food chains and food webs represent energy flow through an ecosystem.* - *Students will be able to assign producer to the first trophic level; consumer to the remaining trophic levels. Within the consumer category they will assign the terms 'herbivore, carnivore, omnivore, predator and prey'.*	Recording first-hand observations of organisms	Consumer Niche Biotic Abiotic Encompasses Trophic level	*https://www.bbc.co.uk/bitesize/guides/z2m39j6/revision/1* *https://www.youtube.com/watch?v=j57hJZPJkuY* *https://www.kayscience.com/d/abiotic-factors-2*
Recycling Materials	• Students will know that the water cycle provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated. Students will know how to explain that water levels on earth are constant using the key words saturation reaching 100% capacity. Transpiration is the transfer of water vapour from a plant to the atmosphere. Evaporation- change from a solid to a liquid. precipitation- rain snow or sleet.	Students need to already know that water is essential to life - Students need to already know how to describe transpiration, and evaporation	Interpret and explain the processes in diagrams of the water cycle.	Transpiration Evaporation Precipitation Condensation Saturation Infiltration Surface run off Interception	https://www.youtube.com/watch?v=ZkXXza5SYTk https://www.bbc.co.uk/bitesize/guides/z72v4wx/revision/3

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
TRIPLE ONLY Decay & Investigating decay	Temperature, water and availability of oxygen affect the rate of decay of biological material. Students should be able to: • calculate rate changes in the decay of biological material • translate information between numerical and graphical form • plot and draw appropriate graphs selecting appropriate scales for the axes. • 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.	Materials decay given the correct conditions. - Composting breaks down materials to release nutrients	Use scientific theories to make a hypothesis about the effect of temperature on rate of decay. Carry out experiments with due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. Make and record observations and measurements. Evaluate method and identify possible improvements. Calculate rate changes in the decay of biological material. Translate information between numerical and graphical form. Plot and draw appropriate graphs selecting appropriate scales for the axes.	Fertiliser Appropriate Optimum Anaerobic Decay Decomposition	https://www.bbc.co.uk/bitesize/guides/zy7gw6f/revision/1 https://www.youtube.com/watch?v=jWMtWJyFaPU
Carbon Cycle	• Students will know that All materials in the living world are recycled to provide the building blocks for future organisms. The carbon cycle returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in photosynthesis. the role of microorganisms in cycling materials	- *Students need to already know that combustion requires oxygen and produces carbon dioxide and water. Photosynthesis equation, the formation of rocks.*	Interpret and explain the processes in diagrams of the carbon cycle.	Photosynthesis Respiration Combustion Decomposer Fossil fuels Abundant Carbohydrate	*https://www.youtube.com/watch?v=ZkXXza5SYTk* *https://www.bbc.co.uk/bitesize/guides/z72v4wx/revision/3*

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	through an ecosystem by returning carbon to the atmosphere as carbon dioxide and mineral ions to the soil. Students will know how to describe the main processes involved with the carbon cycle, combustion (burning of fossil fuels), photosynthesis, respiration, decay. to describe how some carbon dioxide is dissolved into oceans and locked up in rocks.				
Maintaining Biodiversity	• Students will know that Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on ecosystems and biodiversity. These include breeding programmes for endangered species protection and regeneration of rare habitats reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop reduction of deforestation and carbon dioxide emissions by some governments recycling resources rather than dumping waste in landfill. Students will know how to Evaluate given information about methods that can be used to tackle problems caused by human impacts on the environment. Explain and evaluate the conflicting pressures on maintaining biodiversity given appropriate information.	- Students need to already know that some animals are extinct such as the Dodo or Dinosaurs. Some animals are on the endangered list and we can see them in conservation projects.	Evaluate given information about methods that can be used to tackle problems caused by human impacts on the environment. Explain and evaluate the conflicting pressures on maintaining biodiversity given appropriate information	Extinction Destruction Repopulation Endangered Vulnerable Conservation	https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/8 https://www.youtube.com/watch?v=bs9e6ovISbs
Waste Management and Land use	• Students will know that the destruction of peat bogs, and other areas of peat to produce garden compost, reduces the area of this habitat and thus the variety of different plant, animal and microorganism species that live there (biodiversity). The decay or burning of the peat releases carbon	- Students need to already know that humans contribute to destruction of the environment by their activity.	Understand the conflict between the need for cheap available compost to increase food production and the need to conserve peat bogs and peatlands as habitats for biodiversity and to reduce carbon dioxide emissions.	Resources Quarrying Mining Atmosphere Fertiliser Sewage Toxic Landfill Biodiversity	https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/3 https://www.youtube.com/watch?v=SROoINlp4VY https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/5

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	dioxide into the atmosphere. 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. Unless waste and chemical materials are properly handled, more pollution will be caused. • Pollution can occur in water, from sewage, fertiliser or toxic chemicals. In air, from smoke and acidic gases. On land, from landfill and from toxic chemicals. Pollution kills plants and animals which can reduce biodiversity. Students will know how to describe the effects of changing land use, and consider the impact of waste production and changing landscape on the environment. As population increases biodiversity decreases. more land is needed for homes shops, factories and roads.			Eutrophication	
Peat Bogs		-			
Global Warming	• Students will know that biological consequences of global warming Levels of carbon dioxide and methane in the atmosphere are increasing, and contribute to 'global warming'. Students will know how to describe the consequences of global warming. Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications. Explain why evidence is uncertain or incomplete.	- Students need to already know that burning fossil fuels produces carbon dioxide. That Greenhouse gases may contribute toward global warming.	Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications. Explain why evidence is uncertain or incomplete in a complex context.	Deforestation Peer review	https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/6 https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/4 https://www.youtube.com/watch?v=lkqobb34oLI

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
TRIPLE ONLY Food security	Some of the biological factors affecting levels of food security. Food security is having enough food to feed a population. Biological factors which are threatening food security include: • the increasing birth rate has threatened food security in some countries • changing diets in developed countries means scarce food resources are transported around the world • new pests and pathogens that affect farming • environmental changes that affect food production, such as widespread famine occurring in some countries if rains fail • the cost of agricultural inputs • conflicts that have arisen in some parts of the world which affect the availability of water or food. Sustainable methods must be found to feed all people on Earth.	Food is grown on farms Human population is increasing Intensive farming is used to increase the amount of food produced in a short period of time. Famine is the wide spread scarcity of food Intensive farming techniques produce more food in a shorter time period. - .	Interpret population and food production statistics to evaluate food security. Understand that some people have ethical objections to some modern intensive farming methods.	Sustainable Famine Food security Environmental Conflict Agriculture Scarcity	https://www.youtube.com/watch?v=MaWBxZQ8nH Q https://www.bbc.co.uk/bitesize/guides/ztwvk2p/revision/1
TRIPLE ONLY Maintaining Food Security- Farming Techniques	• The efficiency of food production can be improved by restricting energy transfer from food animals to the environment. This can be done by limiting their movement and by controlling the temperature of their surroundings. Some	Intensive farming techniques produce more food in a shorter time period. -	Evaluate the advantages and disadvantages of modern farming techniques. Understand how application of different fishing techniques promotes recovery of fish stocks.	Fisheries Efficiency Environment	https://www.youtube.com/watch?v=_ACn3e4qnaM https://www.bbc.co.uk/bitesize/guides/ztwvk2p/revision/1

Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior Knowledge: *In order to know this, students need to already know that…*	Working Scientifically	Tiered Vocabulary and Reading Activity	Support
	animals are fed high protein foods to increase growth. Fish stocks in the oceans are declining. It is important to maintain fish stocks at a level where breeding continues or certain species may disappear altogether in some areas. Control of net size and the introduction of fishing quotas play important roles in conservation of fish stocks at a sustainable level.				
TRIPLE ONLY Biotechnology	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. The fungus is grown on glucose syrup, in aerobic conditions, and the biomass is harvested and purified. 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.	- Genetic modification is a technique to change the characteristics of a plant, animal or micro-organism by transferring a piece of DNA from one organism to a different organism		Modification Purified Biomass Agricultural techniques	https://www.youtube.com/watch?v=hYlNIuiTm4k https://www.youtube.com/watch?v=Ii-RkMwFSlQ https://www.bbc.co.uk/bitesize/guides/ztwvk2p/revision/5

The Sutton Academy

Knowledge Rich Curriculum Plan

Science – Biology Year 11

Advanced Ecology (Combined)

Science Year 11 Biology					
Lesson/Learning Sequence	**Intended Knowledge:** *Students will know that…*	**Prior knowledge** **In order to know this students should already know that…**	**Working scientifically**	**Tiered vocabulary**	**Support**
Lesson 1: **Review of Key content and key literacy**	Students will know that... • Ecology is a branch of biology that deals with the relationships that organisms have with one another and their physical surroundings. • They will recognise that a habitat is a natural home or environment of an animal or plant or another organism. Community is a group of species that occurs at the same time in the same place. Population is made up of all the members of a species. And that an ecosystem is characteristic set of plants, animals and microbes. • A Niche describes the role an organism plays in a community. A Niche encompasses both the physical and environmental conditions it requires. Biotic factors is a living organism that shapes an environment e.g. New predators, Pathogens, food availability. one species outcompeting another so the numbers are sufficient to breed. Abiotic factors are non living physical conditions. E.g. Temperature, light intensity, Soil pH, mineral content, wind intensity, carbon dioxide levels	• Students will know that arrows on food chains and food webs represent energy flow through an ecosystem. • Students will be able to assign producer to the first trophic level; consumer to the remaining trophic levels. Within the consumer category they will assign the terms 'herbivore, carnivore, omnivore, predator and prey'.	Recording first-hand observations of organisms. Extract and interpret information from charts, graphs and tables.	Consumer Niche Biotic Abiotic Encompasses Trophic level	https://www.bbc.co.uk/bitesize/guides/z2m39j6/revision/1 https://www.youtube.com/watch?v=j57hJZPJkuY https://www.kayscience.com/d/abiotic-factors-2

Science Year 11 Biology					
Lesson/Learning Sequence	**Intended Knowledge:** *Students will know that…*	**Prior knowledge** **In order to know this students should already know that…**	**Working scientifically**	**Tiered vocabulary**	**Support**
	and oxygen levels for aquatic animals.				
Lesson 2: Investigating Predator prey relationships	• Students will know that within a community each species depends on other species for food, shelter, pollination, seed dispersal etc. If one species is removed it can affect the whole community. This is called interdependence. A stable community is one where all the species and environmental factors are in balance so that population sizes remain fairly constant. • Students will know how to extract and interpret information from charts, charts graphs and tables relating to the interaction of organisms within a community.	• Students need to already know that food chains show energy transfer between organisms. they can provide appropriate suggestions of what organisms are competing for.	Extract and interpret information from charts, graphs and tables.	Organism Species Community Interdependence	https://www.bbc.co.uk/bitesize/guides/z9nwtv4/revision/2 https://www.kayscience.com/d/predator-prey-relationships-2
Lesson3: Triple only Trophic Levels (levels or organisation)	• Students should understand that photosynthetic organisms are the producers of biomass for life on Earth. Feeding relationships within a community can be represented by food chains. All food chains begin with a producer which synthesises molecules. This is usually a green plant or alga which makes glucose by photosynthesis. Producers are	Students need to already know that there predator prey relationships and this can affect numbers.	Extract and interpret information from charts, graphs and tables.	Primary consumer, secondary consumer, tertiary consumer	https://www.youtube.com/watch?v=j57hJZPJkuY https://www.bbc.co.uk/bitesize/guides/zs7gw6f/revision/1

Science Year 11 Biology					
Lesson/Learning Sequence	**Intended Knowledge:** *Students will know that…*	**Prior knowledge** **In order to know this students should already know that…**	**Working scientifically**	**Tiered vocabulary**	**Support**
	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. • Students will know how to construct food chains, food webs, pyramids of number and pyramids of biomass				
Lesson 4: Sampling Techniques RP	• Students will know that a range of experimental methods using transects and quadrats are used by ecologists to determine the distribution and abundance of species in an ecosystem. • Students will know how to measure the population size of a common species in a habitat such as daisies. Use sampling techniques to investigate the effect of a factor on the distribution of this species.	• Students need to already know that Predators are at the top of a food chain. Producers start a food chain as they can photosynthesise • Students need to already know how to interpret graphs, calculate means plot and draw appropriate graphs selecting appropriate scales for the axes	Apply a range of techniques, including the use of transects and quadrats, and the measurement of an abiotic factor. Estimates of population size based on sampling. Develop hypotheses regarding distribution of a species as a consequence of a factor. Plan experiments to test hypotheses on distribution. Apply a range of techniques, including the use of transects and quadrats, and the measurement of an abiotic factor.	Abundance Distribution Habitat Bias Transects Quadrat Biotic Abiotic	https://www.bbc.co.uk/bitesize/guides/z83qcj6/revision/3 https://www.kayscience.com/d/quadrats-using-transects-2 https://www.kayscience.com/d/quadrats-calculating-percentage-cover-2

Science Year 11 Biology					
Lesson/Learning Sequence	**Intended Knowledge:** *Students will know that…*	**Prior knowledge** **In order to know this students should already know that…**	**Working scientifically**	**Tiered vocabulary**	**Support**
Lesson 5: Animal adaptations	• Students will know that organisms are adapted to live in their natural environment. 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. • Students will know how to explain an animal is adapted and how this depends on the animal habitat.	Students need to already know that environment can affect the needs of living things, the arctic is Tundra (cold), the desert is arid (hot and dry).		Adaptation, Physical adaptation, Behavioural adaptation, Functional adaptatioln, structural adaptation, constrict, extremophile	https://www.bbc.co.uk/bitesize/guides/z9pd6yc/revision/9 https://www.youtube.com/watch?v=DTQtoZwIdN8 https://www.youtube.com/watch?v=2Kt_6BwYtG4
Lesson 6: Adaptations in plants (extremophiles)	• Students will know that plants are adapted to live in their natural environment. 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. Some organisms live in environments that are very extreme, such as at high temperature, pressure, or salt concentration. These organisms are called extremophiles. Bacteria living in deep sea vents are extremophiles.	Students need to already know that Plants are living things and can respond the environment.		Extremophiles Waxy Cuticle Transpiration Photosynthesis Humidity	https://www.bbc.co.uk/bitesize/guides/z9pd6yc/revision/8 https://www.youtube.com/watch?v=-P3P6oJEfFU
Lesson 7: The carbon cycle	• Students will know that All materials in the living world are recycled to provide the building blocks for future organisms. The carbon cycle returns carbon from organisms to the atmosphere as carbon dioxide to be used by plants in	Students need to already know that combustion requires oxygen and produces carbon dioxide and water. Photosynthesis equation, the formation of rocks.	Interpret and explain the processes in diagrams of the carbon cycle.	Photosynthesis Respiration Combustion Decomposer Fossil fuels Abundant Carbohydrate	https://www.bbc.co.uk/bitesize/guides/zg9v6yc/revision/2 https://www.youtube.com/watch?v=YrSmyQfaZfk

Science Year 11 Biology					
Lesson/Learning Sequence	**Intended Knowledge:** *Students will know that…*	**Prior knowledge** **In order to know this students should already know that…**	**Working scientifically**	**Tiered vocabulary**	**Support**
	photosynthesis. 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. • Students will know how to describe the main processes involved with the carbon cycle, combustion (burning of fossil fuels), photosynthesis, respiration, decay. to describe how some carbon dioxide is dissolved into oceans and locked up in rocks.				
Lesson 8: **Water cycle.**	• Students will know that the water cycle provides fresh water for plants and animals on land before draining into the seas. Water is continuously evaporated and precipitated. • Students will know how to explain that water levels on earth are constant using the key words saturation reaching 100% capacity. Transpiration is the transfer of water vapour from a plant to the atmosphere. Evaporation- change from a solid to a liquid. precipitation- rain snow or sleet.	Students need to already know that water is essential to life Students need to already know how to describe transpiration, and evaporation	Interpret and explain the processes in diagrams of the water cycle.	Transpiration Evaporation Precipitation Condensation Saturation Infiltration Surface run off Interception	https://www.youtube.com/watch?v=ZkXXza5SYTk https://www.bbc.co.uk/bitesize/guides/z72v4wx/revision/3

Science Year 11 Biology					
Lesson/Learning Sequence	**Intended Knowledge:** *Students will know that…*	**Prior knowledge** **In order to know this students should already know that…**	**Working scientifically**	**Tiered vocabulary**	**Support**
Lesson 9: **Land use and waste management**	• Students will know that the destruction of peat bogs, and other areas of peat to produce garden compost, reduces the area of this habitat and thus the variety of different plant, animal and microorganism species that live there (biodiversity). The decay or burning of the peat releases carbon dioxide into the atmosphere. 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. Unless waste and chemical materials are properly handled, more pollution will be caused. • Pollution can occur in water, from sewage, fertiliser or toxic chemicals. In air, from smoke and acidic gases. On land, from landfill and from toxic chemicals. Pollution kills plants and animals which can reduce biodiversity. • Students will know how to describe the effects of changing land use, and consider the impact of waste production and changing landscape on the environment. As population increases biodiversity decreases. more land is needed for homes shops, factories and roads.	Students need to already know that humans contribute to destruction of the environment by their activity.	Understand the conflict between the need for cheap available compost to increase food production and the need to conserve peat bogs and peatlands as habitats for biodiversity and to reduce carbon dioxide emissions.	Resources Quarrying Mining Atmosphere Fertiliser Sewage Toxic Landfill Biodiversity Eutrophication	https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/3 https://www.youtube.com/watch?v=SROoINlp4VY https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/5

Science Year 11 Biology					
Lesson/Learning Sequence	**Intended Knowledge:** *Students will know that…*	**Prior knowledge** **In order to know this students should already know that…**	**Working scientifically**	**Tiered vocabulary**	**Support**
Lesson 10: Global warming and deforestation	• Students will know that biological consequences of global warming Levels of carbon dioxide and methane in the atmosphere are increasing, and contribute to 'global warming'. • Students will know how to describe the consequences of global warming. Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications. Explain why evidence is uncertain or incomplete.	Students need to already know that burning fossil fuels produces carbon dioxide. That Greenhouse gases may contribute toward global warming.	Evaluate the environmental implications of deforestation. Understand that the scientific consensus about global warming and climate change is based on systematic reviews of thousands of peer reviewed publications. Explain why evidence is uncertain or incomplete in a complex context.	Deforestation Peer review	https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/6 https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/4 https://www.youtube.com/watch?v=lkqobb34oLI
Lesson 11: Maintaining biodiversity	• Students will know that Scientists and concerned citizens have put in place programmes to reduce the negative effects of humans on ecosystems and biodiversity. These include breeding programmes for endangered species protection and regeneration of rare habitats reintroduction of field margins and hedgerows in agricultural areas where farmers grow only one type of crop reduction of deforestation and carbon dioxide emissions by some governments recycling resources rather than dumping waste in landfill.	Students need to already know that some animals are extinct such as the Dodo or Dinosaurs. Some animals are on the endangered list and we can see them in conservation projects.	Evaluate given information about methods that can be used to tackle problems caused by human impacts on the environment. Explain and evaluate the conflicting pressures on maintaining biodiversity given appropriate information.	Extinction Destruction Repopulation Endangered Vulnerable Conservation	https://www.bbc.co.uk/bitesize/guides/z93mk2p/revision/8 https://www.youtube.com/watch?v=bs9e6ovISbs

Science Year 11 Biology						
Lesson/Learning Sequence	Intended Knowledge: *Students will know that…*	Prior knowledge In order to know this students should already know that…	Working scientifically	Tiered vocabulary	Support	
	• Students will know how to Evaluate given information about methods that can be used to tackle problems caused by human impacts on the environment. Explain and evaluate the conflicting pressures on maintaining biodiversity given appropriate information.					

Lesson 12: Changing the environment TRIPLE	Students should be able to evaluate the impact of environmental changes on the distribution of species in an ecosystem given appropriate information. Environmental changes affect the distribution of species in an ecosystem. These changes include: • temperature • availability of water • composition of atmospheric gases. The changes may be seasonal, geographic or caused by human interaction.	Environmental conditions can affect distribution of animals	There are links with this content to Biodiversity and the effect of human interaction on ecosystems.	Atmosphere Distribution Environment Composition Appropriate		https://www.youtube.com/watch?v=fZxw0QiaSN4 https://www.bbc.co.uk/bitesize/guides/zt8f4qt/revision/1

Lesson 13: Investigating decay TRIPLE	Temperature, water and availability of oxygen affect the rate of decay of biological material. Students should be able to: • calculate rate changes in the decay of biological material • translate information between numerical and graphical form • plot and draw appropriate graphs selecting appropriate scales for the axes. 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.	Materials decay given the correct conditions. Composting breaks down materials to release nutrients		Fertiliser Appropriate Optimum Anaerobic Decay Decomposition		https://www.bbc.co.uk/bitesize/guides/zy7gw6f/revision/1 https://www.youtube.com/watch?v=jWMtWJyFaPU
Lesson 14: learning about food security TRIPLE	Some of the biological factors affecting levels of food security. Food security is having enough food to feed a population. Biological factors which are threatening food security include: • the increasing birth rate has threatened food security in some countries • changing diets in developed countries means scarce food resources are transported around the world	Food is grown on farms Human population is increasing Intensive farming is used to increase the amount of food produced in a short period of time. Famine is the wide spread scarcity of food.	Interpret population and food production statistics to evaluate food security.	Sustainable Famine Food security Environmental Conflict Agriculture Scarcity		https://www.youtube.com/watch?v=MaWBxZQ8nH Q https://www.bbc.co.uk/bitesize/guides/ztwvk2p/revision/1

	• new pests and pathogens that affect farming • environmental changes that affect food production, such as widespread famine occurring in some countries if rains fail • the cost of agricultural inputs • conflicts that have arisen in some parts of the world which affect the availability of water or food. Sustainable methods must be found to feed all people on Earth.					
Lesson 15: Maintaining food security TRIPLE	• The efficiency of food production can be improved by restricting energy transfer from food animals to the environment. This can be done by limiting their movement and by controlling the temperature of their surroundings. Some animals are fed high protein foods to increase growth. • Fish stocks in the oceans are declining. It is important to maintain fish stocks at a level where breeding continues or certain species may disappear altogether in some areas. Control of	Intensive farming techniques produce more food in a shorter time period.	Understand that some people have ethical objections to some modern intensive farming methods. Evaluate the advantages and disadvantages of modern farming techniques. Understand how application of different fishing techniques promotes recovery of fish stocks.	Fisheries Efficiency Environment		https://www.youtube.com/watch?v=_ACn3e4qnaM https://www.bbc.co.uk/bitesize/guides/ztwvk2p/revision/1

	net size and the introduction of fishing quotas play important roles in conservation of fish stocks at a sustainable level.					
Lesson 16: Milk PH Decay RP TRIPLE	Investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change. Use appropriate apparatus to record temperature and pH. The use of appropriate apparatus to measure anaerobic decay. Safe use of microorganisms. Measurement of rate of decay by pH change	In order to decay the conditions need to be warm, oxygen rich and moist	Use scientific theories to make a hypothesis about the effect of temperature on rate of decay. Carry out experiments with due regard for the correct manipulation of apparatus, the accuracy of measurements and health and safety considerations. Make and record observations and measurements. Evaluate method and identify possible improvements. Calculate rate changes in the	Decay Decomposition Anaerobic Temperature		https://www.kayscience.com/d/decay-s https://www.bbc.co.uk/bitesize/guides/zy7gw6f/revision/1 https://www.youtube.com/watch?v=jWMtWJyFaPU

			decay of biological material. Translate information between numerical and graphical form. Plot and draw appropriate graphs selecting appropriate scales for the axes.			
Lesson 17: Transferring Biomass TRIPLE	Describe pyramids of biomass, Explain how biomass is lost between the different trophic levels. Students should be able to calculate the efficiency of biomass transfers between trophic levels by percentages or fractions of mass. Students will be able to explain how this affects the number of organisms at each trophic level. Losses of biomass are due to: • not all the ingested material is absorbed, some is egested as faeces • some absorbed material is lost as waste, such as carbon dioxide and water in respiration and water and urea in urine.	Producers are mostly plants and algae. Pyramids of biomass reveal the mass of living material at each stage in a chain.	Calculate the efficiency of biomass transfer between trophic levels.	Biomass Ingested Respiration Trophic Egested Efficiency		https://www.youtube.com/watch?v=sgh1OWm0oTQ https://www.bbc.co.uk/bitesize/guides/zs7gw6f/revision/3

	Large amounts of glucose are used in respiration.					
Lesson 18: Using Biotechnology	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. The fungus is grown on glucose syrup, in aerobic conditions, and the biomass is harvested and purified. 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.	Genetic modification is a technique to change the characteristics of a plant, animal or micro-organism by transferring a piece of DNA from one organism to a different organism	There are links with this content to Genetic engineering.	Biotechnical Modification Purified Biomass Agricultural techniques		https://www.youtube.com/watch?v=hYlNIuiTm4k https://www.youtube.com/watch?v=Ii-RkMwFSlQ https://www.bbc.co.uk/bitesize/guides/ztwvk2p/revision/5