Term	1	2	3
Y12	**Forensics Induction** This topic introduces various laboratory techniques. The main focus is to secure students' interest in Biology, and to boost confidence in the lessons. Practical work includes microscopy, food tests, calibration curves, observational and team work skills.	**DNA and Protein Synthesis** Students learn about how genetic information is used to make specific proteins in cells, DNA structure, chromosome structure, the human genome project, the stages of protein synthesis and the chemicals involved. Teachers encourage students to apply their knowledge and take an interest in recent developments in genetic research.	**Energy Transfers in Ecosystems** Students study the organisation of ecosystems in terms of trophic levels, how energy is transferred from one trophic level to another, the various mechanisms by which energy is lost between trophic levels, net and gross primary productivity, what intensive farming is and how it increases productivity / profits, and integrated pest management. Mathematical skills are developed, including working with standard form, percentages and conversion of units. Students also practise evaluating data by studying various agricultural practices, taking into account productivity, profit, environmental issues and animal welfare.
	Cells Students learn about eukaryotic and prokaryotic cell structure, units used to measure cells, how electron microscopes work and are used, the size and function of eukaryotic organelles. Microscope and observational skills are focused on, including preparing samples for cell fractionation, observing the results, how to calibrate a stage micrometre with the eyepiece graticule, converting between units, and following instructions for the gram stain procedure. Students also prepare stained slides of root tips from which to record and identify stages of mitosis observed, calculating the mitotic index (the percentage of visible cells in each stage), and use the statistical test chi squared to analyse their results.	**Immunology** This topic gives students a thorough introduction to infectious diseases with examples, an overview of body defences (specific, broken down into humoral and cell-mediated, and non-specific), phagocytosis, roles of b cells, t cells, helper t cells, cytotoxic t cells, memory cells, and plasma cells in the specific immune response; types of immunity and vaccines; antigenic variability; HIV structure and progression of the disease; monoclonal antibody production and use, specifically in ELISA as a test for HIV. Student continue to improve their data analysis skills by assessing the effectiveness of vaccines / treatments / drugs in preventing / treating infectious disease.	**Mass Transport** Students study haemoglobin structure and function; oxygen dissociation curves including those in different species; features of the circulatory system; structure and function of arteries, veins and capillaries; formation and function of tissue fluid; heart structure and the cardiac cycle; transpiration and translocation. Students practise selecting sources and assessing their reliability when researching different examples of oxygen dissociation curves in different species; focussing microscopes; drawing biological images from microscopes; dissection skills and drawing biological images from specimens; using dissection tools safely; analysing data about risk factors (for CHD) and distinguish between correlations and causal relationships; Student's T test to disprove a null hypothesis; assessing quality of evidence (for translocation).
	Carbohydrates and Lipids . In this topic students will learn about some of the different types of biological molecules (monosaccharides, disaccharides, polysaccharides, glycerol, fatty acids, triglycerides, phospholipids) and their roles in cells. Students practise following instructions, using a serial dilution to produce a calibration curve, working methodically, developing the ability to 'multi-task' (carrying out one test while preparing for the repeat test is a good example of this), identifying the hazards and	**Genetic Diversity** Students learn about DNA mutations, cystic fibrosis, the mechanisms that produce variation, natural selection, directional and stabilising selection, antibiotic resistance, the binomial naming system, phylogenetic hierarchy, courtship behaviour, amino acid, RNA and DNA sequencing, index of diversity. They practice using power numbers, aseptic technique, reviewing exponential growth, using logs, and calculating standard deviation.	**Populations in Ecosystems** This topic includes an introduction in school, and then our Biology Fieldwork Course in North Wales (5 nights, Rhyd-y-Creau Field Centre) with additional input from specialist ecologists at the field centre. Students study abiotic and biotic factors and their impact on population sizes with predator-prey relationships and bacterial growth curves as specific examples; theory of different ecological sampling techniques; succession, conservation, *in situ* introduction to various

	the risks associated with those hazards, writing a risk assessment, constructing tables and recording data.		biological organisms e.g. limpets, moss, lichen, holly leaf miner, xerophytes, freshwater invertebrates. Students develop their understanding of and practise using logarithmic scales, carrying out various ecological sampling techniques (random sampling, transects, mark-release-recapture), evaluating the limitations of each technique, choosing and using statistical tests to analyse experimental data, writing methods, identifying and controlling variables, using a range of equipment to monitor abiotic factors, and using choice chambers.
	Proteins and Enzymes Students learn that proteins are polymers of amino acids. They study enzymes, which are one class of proteins, and are biological catalysts and speed up chemical reactions in living organisms. Students investigate the factors that affect enzyme action: temperature, pH, enzyme concentration, substrate concentration. Students practise following instructions, working methodically and using the most appropriate equipment correctly, identifying the hazards and the risks associated with those hazards, writing a risk assessment, constructing results tables and recording data in a suitable manner, evaluating their results and suggesting ways to improve their experiments.	**Exchange** Students study the importance of SA:Vol for exchange of substances within organisms and with the surroundings, features of an effective exchange surface, the structure and function of the following exchange surfaces: fish gills, insects tracheoles, leaves, small intestine, human lungs. Adaptations of insects and leaves to reduce water loss. Digestion of carbohydrates, proteins and lipids. We practise calculating SA:Vol, using potometers to measure transpiration, calculating lung volumes in humans using data from spirometers and peak flow meters, dissection and biological drawing skills. Students also apply their knowledge of human lungs and gas exchange to diagnose various lung diseases and their risk factors, including a focus on assessing the reliability and accuracy of data. Use of Spearman's rank correlation coefficient statistical test	
	Cell Transport Students learn the structure and functions of the plasma membrane, simple and facilitated diffusion, osmosis in terms of water potential, active transport and endo/exocytosis, maintaining water balance and turgidity in cells, absorbing glucose from the small intestine by co-transport dependent on the sodium-potassium pump, oral rehydration therapy. In practical work, students use a colorimeter, considering how to control key variables.		**Year 12 School Exams**
	DNA and Inorganic Molecules Students learn the structure of water and its properties, and how this is important for living organisms, the roles of inorganic ions in living organisms, the structure, formation and functions of ATP, the structures of DNA and RNA and an overview of their functions, replication of DNA by semiconservative replication. We further work on drawing biological molecules and identifying bonding types. Students make links to history by using historical experiments to explain our current knowledge – the elucidation of semiconservative DNA replication.		

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Y13	**Photosynthesis** Students are introduced to the topic with an overview of the flow of energy through ecosystems. They then study in detail compensation points; role of ATP in energy transfers; leaf structure; chloroplast and photosynthetic pigments structure and function; role of REDOX reactions in photosynthesis; light dependent reactions including photolysis, chemiosmosis, photophosphorylation; light independent reactions including Calvin cycle and production of various carbohydrates using glucose; limiting factors for photosynthesis. Students carry out lots of practical work, including chromatography. Students hone various practical skills: writing risk assessments, evaluating various methods for an investigation; selecting sources and assessing their reliability when researching different examples of the products of photosynthesis; drawing complex graphs with curved lines of best fit; calculating rate oxygen production from experimental data; essay skills in Biology.	**Responses for Survival** Students study phototropism; gravitropism; IAA and other plant hormones; taxes and kinesis; reflex actions and the neurones involved; resting and action potential and the roles of ion channels and the Na^+K^+ pump; factors that affect the speed of action potentials; the all or nothing principle of action potentials; the refractory period. Students discuss the contributions of many scientists to our understanding of plant hormones; they practise identifying and controlling control variables; risk assessments; using Student's T test; standard deviation; percentage change; writing conclusions and evaluations.	**Homeostasis** Student study negative feedback, thermoregulation in endotherms and ectotherms; blood glucose regulation by insulin, glucagon and adrenaline; second messenger pathways; diabetes; kidney structure and function including Bowman's capsule, proximal convoluted tubule, loop of Henle, distal convoluted tubule; collecting duct; role of ADH in regulation of blood water potential. Students practise selecting sources and assessing their reliability when researching different examples of endotherms and ectotherms; dissection skills; using sharp instruments safely; calibration curves; risk assessments; using colourimeters; referencing research; handling biological specimens appropriately.
	Inheritance Students learn about monohybrid and dihybrid inheritance; codominance; inheritance of blood groups; sex-linked genes; autosomal linkage and the effect of phenotype/genotype ratios; epistasis; gene pools; allele frequencies; Hardy-Weinberg formula; continuous and discontinuous variation and their causes; natural selection; stabilising, directional and disruptive selection; allopatric and sympatric speciation; genetic drift. They practise drawing genetic diagrams; interpreting pedigree diagrams; chi^2 statistical test; usinge the Hardy-Weinberg calculation.	**Gene Expression and Technology** Students learn about the causes and types of gene mutation; regulation of transcription by transcription factors, oestrogen and siRNA; totipotent and pluripotent stem cells; sources of stem cell; cell differentiation; epigenomics; oncogenes and tumour suppressor genes; genome sequencing; proteomics; recombinant DNA; in vivo cloning; transformation; PCR; genetic screening using DNA probes and DNA hybridisation, genetic fingerprinting. Skills that students will work on in this topic are aseptic technique; using sharp instruments safely; discussing ethics of genetic technologies in medicine and research; interpreting data on gene expression; essay skills in biology; understanding the contributions of many scientists to genome sequencing and how methods have changed over time; ethics of genetic screening.	**Muscles** Students learn the macro and micro structure of muscle; function of neuromuscular junctions; mechanism of muscle contraction; differences between slow and fast twitch muscle fibres. Students further work on using microscopes with oil immersion lenses; drawing biological images; modelling muscle function and analysing models.
	Nutrient Cycles Students learn about the nitrogen cycle including the bacteria involved; phosphorous cycle; natural and artificial fertilisers; eutrophication,	**Receptors to Effectors** Students learn about generator potentials; Pacinian corpuscles; rods and cones in the eye and the structure of the retina; control of	**External A Level Exams**

	indicator species. Skills that are practised include aseptic technique; writing risk assessments; essay skills in biology. **Respiration** Students learn the structure of the mitochondria, stages of respiration to include glycolysis, link reaction, Kreb's cycle, oxidative phosphorylation; role of ATP and REDOX reactions in respiration; anaerobic respiration in animal, plant and fungal cells. In practicals, students practise using respirometers; working safely and ethically with living organisms; modelling respiration and evaluating these models; comparing respiration and photosynthesis; essay skills in biology.	heart rate involving chemoreceptors and baroreceptors; structure and function of synapses; the effect of drugs on synapse function. Students practise their dissection skills; using sharp instruments safely; presenting skills; selecting sources and assessing their reliability when researching different examples of drugs which affect synapses.	