Year	Topic	Knowledge	Skills
7	**Cells**	Animal and plant cells, specialised cells, unicellular organisms and diffusion.	Beginning to use a microscope and learning how they work, preparing simple slides, safely handling chemicals and equipment, using basic laboratory equipment e.g. beakers, stopwatches, drawing labelled diagrams, introduction to answering 6 mark questions, using new scientific terminology correctly.
	Structure and Function of Body Systems	Organisation in organisms, gas exchange, breathing, skeleton, joints, muscles.	Working out how mass affects the force needed to make a muscle work, using Newton meters, recording data in a simple table, drawing labelled diagrams, answering 6-mark questions, using new scientific terminology correctly, measuring volumes.
	Reproduction	Adolescence, internal and external fertilisation, human reproductive systems, fertilisation and implantation, development of the foetus, menstrual cycle, plant reproductive systems, fertilisation and germination, seed dispersal.	This topic provides lots of opportunity for questions and discussion, allowing students to develop respect and responsibility. Line and bar graph drawing and error spotting, calculating means and percentages, introducing ideas of accuracy and precision, identifying variables in an investigation, beginning to plan simple methods.
8	**Health and Lifestyle**	Food groups and healthy eating, energy from food, digestive system, enzymes, drugs, alcohol, smoking.	Using a Bunsen burner to burn food, food tests and identifying unknowns, following complex instructions, answering 6 mark questions, using new scientific terminology correctly and discussion of lifestyle choices and their negative impacts on health. This topic includes some more extended writing tasks to develop literacy skills, graph drawing.
	Ecosystem Processes	Photosynthesis, structure of a leaf, anaerobic and aerobic respiration, chemosynthesis, fertilisers, food webs and chains, bioaccumulation, population changes and ecosystems.	Practical skills revisited including using Bunsen burners and microscopes. New practical techniques of sampling using quadrats, introduction to writing risk assessments, identifying variables, drawing tables. This topic includes some more extended writing tasks to develop

			literacy skills and drawing labelled diagrams, graph drawing.
	Adaptation and Inheritance	Predator-prey relationships and interdependence, adaptations, variation, DNA, theories of evolution, natural selection and extinction, continuous and discontinuous variation.	More extended writing/reading on the history of how scientists worked together to discover DNA, lot of opportunities for discussions and evaluations of scientific theories and evidence for and against them whilst also gaining an appreciation that there are different religious views too.
9	**Cell Structure and Transport**	Electron microscopes and general microscopy, eukaryotic and prokaryotic cell structure, specialised cell structures, orders of magnitude, roles of diffusion, osmosis and active transport in the movement of materials within and between cells, adaptations to increase the rate of transport in and out of cells.	Using microscopes, microscope drawings, calculating magnification, drawing scale bars, making slides, converting between units, first examples of GCSE style exam questions, surface area to volume ratio calculations, drawing graphs with negative axis and using lines of best fit to make predictions, literacy exercise to analyse microscopy vocabulary. RP 1 + 3.
	Cell Division	The role of DNA, chromosomes, genes in a cell, how cells divide by mitosis, differentiation, cloning, stem cells.	Microscope drawings, first attempt at GCSE 6-mark question – factual recall, analysis and evaluation of advantages and disadvantages of contentious issues.
	Enzymes and Digestion	Tissues, organs, organ systems, digestive system, structure of biological molecules, role of enzymes in digestion and factors that affect them, bile and the liver.	Practical complexity increasing to include multiple conditions and repeats, further attempt at 6-mark question (still factual recall), extension activity offers opportunity to use A Level vocabulary in a scaffolded way. RP 4 + 5
	Organising Animals and Plants	Blood, double circulatory system, valves, blood vessels, detailed structure of the heart, gas exchange system in mammals and plants, organisation and transpiration in plants.	Observation of heart dissection (provides introduction to sharps handling).
	Non-Communicable Disease	Lifestyle factors, causal mechanisms, cancer, smoking and CV disease, lung disease and the effect on foetuses, diet, exercise, type 2 diabetes, alcohol and the effect on the liver, brain and foetuses, carcinogens, stents, artificial hearts, valves and pacemakers, statins,	Analysis of relative sizes of different risks to health, analysis of large data sets (population level health risks and effects), interpreting data in terms of correlation versus causation, calculating BMI, evaluation of various slimming schemes.

			Analysis and application of knowledge to explain various treatments for cardiovascular disease, evaluation of their benefits and risks
	Respiration	The biochemistry of respiration, effects of exercise, anaerobic respiration, metabolism, the role of the liver in oxygen debt.	Balanced symbol equations, planning an experiment, analysis of data collected, cardiac output calculations, efficiency calculations (extension).
	Adaptations and Interdependence	The role of organisms in communities and ecosystems, abiotic and biotic factors, techniques to measure the distribution of living organisms, factors that plants and animals compete for, examples of the adaptations they have to enable this.	Use of mean, mode, median, significant figures, evaluating fieldwork methods, calculating index of diversity (extension). RP 9
10	**Nervous System**	Key elements of control systems, structure and function of nervous system, receptors, co-ordinators, effectors, reflexes, the brain, the eye and focusing, near and short sightedness,	Further practice at 6-mark questions – factual recall with some application, modelling the synapse, evaluation of different methods of measuring reaction times, planning own experimental methods and evaluating reliability and accuracy. RP 7
	Communicable Disease	Causes of ill health, types of pathogen, binary fission, aseptic technique, reducing the spread of disease, examples of disease including measles, HIV, salmonella, gonorrhoea, malaria, immunity and the role of white blood cells, vaccination, drug discovery and testing including penicillin, monoclonal antibodies.	Aseptic technique, interpret data on graphs about health, measure growth of bacteria, analyse exponential graphs, critical review of the testing of new medicines. RP 2
	Reproduction and Inheritance	Sexual and asexual reproduction, meiosis and variation, DNA and the genome, gene expression and protein synthesis, mutations, rules of inheritance and Punnett squares, inheritance of gender, family trees, polydactyly, cystic fibrosis, screening for genetic disorders.	Literacy skills when analysing text about sexual and asexual variation, flower dissection (handling sharps), evaluation of benefits and risks of different methods of embryo screening, drawing Punnett squares.
	Variation and Evolution	Environmental and genetic variation, natural selection, selective breeding, methods of cloning (cuttings, tissue cloning,	Calculate bacterial population growth, evaluate advantages and disadvantages of various types of cloning, practice 6 mark exam

		embryo cloning, adult cell cloning) and uses of cloning. Producing GMO. Ethics of these technologies.	questions (analysis and evaluation).
	Genetics and Evolution	The work of Mendel, the theory of evolution by natural selection and the evidence for it, the ideas of Lamarck, Wallace and Darwin, speciation, the formation of and importance of fossils, causes of extinction, antibiotic resistance in bacteria as an example of evolution, classification systems and how they have changed over time.	Evaluation of the strength of evidence to support various theories, literacy skills when analysing text about Darwin, interpretation of complex graphs, considerations of different viewpoints through history.
	Photosynthesis	Describe photosynthesis in terms of reactants, products, limiting factors and conditions, adaptations of leaves, uses of glucose in plants, examples of plant disease including tobacco mosaic virus, rose black spot, mineral deficiencies, plant defence responses.	Lines of best fit and gradients, writing risk assessments, 6 mark exam question practice (experimental methods/results), balanced symbol equations. RP 6
Y11	**Hormones**	What hormones are, role of pituitary gland, role of hormones in maintaining blood glucose concentration, diabetes, thyroxine, negative feedback, puberty, reproductive hormones and the menstrual cycle, contraception, treating infertility, plant hormones and responses, uses of plant hormones. The use of genetic engineering to make insulin.	Investigation planning, interpreting complex graphs, evaluate different methods of contraception, consider different viewpoints on IVF, literacy skills – using key scientific vocabulary. Evaluate the use of genetic engineering to make insulin. RP 8
	Homeostasis	Regulation of body temperature, removal of waste products, role of kidneys in regulation of blood water and mineral ion content, kidney dialysis and transplants. The use of therapeutic cell cloning as a potential source of kidneys for transplant.	Calculating percentage changes, evaluating models, evaluating different treatments for kidney failure, kidney dissection (sharps handling). Evaluate the use of therapeutic cell cloning.
	Organising an Ecosystem	Feeding relationships and the importance of photosynthesis, predator-prey relationships, decay and the recycling of materials, particularly carbon and water, factors that affect the rate of decomposition, trophic levels	Interpreting complex graphs, experiment planning, balanced symbol equations, percentage change and efficiency calculations. RP 10

		and pyramids of biomass, biomass and energy transfers between trophic levels.	
	Humans and the Environment	Importance of biodiversity, how humans pollute the air, land and water, the causes and effects of deforestation, peat bog destruction and global warming, the impact of environmental changes of the distribution of organisms, actions humans can take to protect biodiversity, food security and factors that affect it, methods to increase the efficiency of food production including intensive versus extensive farming, sustainable fishing, mycoprotein.	Data analysis, evaluation of issues surrounding climate change, evaluate the benefits and risks of different methods of food production and genetic technologies, graph gradient calculations, analysis of issues surrounding and evaluation of solutions to global food production.
Y12 Both teachers	**Forensics Induction**	Topic introduces various techniques. The main focus is to get students interested in Biology, talking to each other and to boost confidence in the lessons.	Microscopy, food tests, calibration curves, succession, observational and team work skills.
Y12 Teacher A	**Cells**	Eukaryotic and prokaryotic cell structure, units used to measure cells, how electron microscopes work and are used, the size and function of eukaryotic organelles, how to rearrange I=AxM to calculate image size, actual size or magnification from information provided, organisation of cells into tissues, organs and organ systems, the cause of cholera symptoms and its treatment.	Microscope and observational skills, preparing samples for cell fractionation, observing the results, how to calibrate a stage micrometre with the eyepiece graticule, converting between units, practise following instructions for the gram stain procedure.
	Mitosis	The cell cycle, how cancer develops, how drugs target cancer cells to disrupt mitosis, binary fission in prokaryotic cells, viral replication using host cell organelles.	Preparing 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), the statistical test chi squared.
	Cell Transport	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	Using a colorimeter, considering how to control key variables.

		by co-transport dependent on the sodium-potassium pump, oral rehydration therapy.	
	DNA and Protein Synthesis	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.	Encouraging students to apply their knowledge and take an interest in recent developments in genetic research.
	Immunology*[1]	Introduction to infectious diseases with examples, 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, 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.	Data analysis to assess effectiveness of vaccines/treatments/drugs in preventing/treating infectious disease.
	Genetic Diversity	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.	Practicing using power numbers, aseptic technique, reviewing exponential growth, practising using logs, calculating standard deviation.
	Energy Transfers in Ecosystems	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, integrated pest management.	Mathematical skills, including working with standard form, percentages and conversion of units, evaluating various agricultural practices, taking into account productivity, profit, environmental issues and animal welfare.
	Populations in Ecosystems*[2]	Review of GCSE ecological terminology with introduction of A Level words: niche, biome, carrying capacity; study if abiotic	Understanding and using logarithmic scales, carrying out various ecological sampling techniques (random sampling,

	& **Biology Fieldwork Course**	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 biological organisms e.g. limpets, moss, lichen, holly leaf miner, xerophytes, freshwater invertebrates.	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, writing risk assessments, chromatography, drawing results tables, carrying out own research, using dichotomous keys to identify and classify organisms, energy transfer calculations, using choice chambers.
Y12 Teacher B	**Carbohydrates and Lipids**	Biological molecules are the fundamental building blocks of all cells and organisms. There are several key molecules found in all cells that react with each other in similar ways. These biologically important molecules are all carbon-based and the ones covered in this topic are carbohydrates and lipids. Many biological molecules, including carbohydrates, are polymers. This means they are long molecules made up of lots of smaller building blocks. 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.	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 the risks associated with those hazards, writing a risk assessment, constructing tables and recording data.
	Proteins and Enzymes	Proteins are polymers or amino acids. This means they are long molecules made up of lots of smaller building blocks. Enzymes are one class of proteins, and are biological catalysts and speed up chemical reactions in living organisms. Their action can be affected by temperature, pH, enzyme concentration, substrate concentration.	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.

	DNA and Inorganic Molecules	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.	Drawing biological molecules and identifying bonding types. Using historical experiments to explain our current knowledge – the elucidation of semiconservative DNA replication. Observational skills – looking at "everyday" properties of water and trying to use higher level explanations.
	Immunology*[1]	Introduction to infectious diseases with examples, 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, 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.	Data analysis to assess effectiveness of vaccines/treatments/drugs in preventing/treating infectious disease.
	Exchange	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.	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. Applying 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
	Mass Transport	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.	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; analyse data about risk factors (for CHD) and distinguish between correlations and causal

			relationships; Student's T test to disprove a null hypothesis; assess quality of evidence (for translocation).
	Populations in Ecosystems*2 **&** **Biology Fieldwork Course**	Review of GCSE ecological terminology with introduction of A Level words: niche, biome, carrying capacity; study if 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 biological organisms e.g. limpets, moss, lichen, holly leaf miner, xerophytes, freshwater invertebrates.	Understanding and 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, writing risk assessments, chromatography, drawing results tables, carrying out own research, using dichotomous keys to identify and classify organisms, energy transfer calculations, using choice chambers.
Y13 Teacher A	**Photosynthesis**	Overview of the flow of energy through ecosystems; 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.	Opportunity to meet all CPAC in RP7: chromatography; additional opportunities to write risk assessments, evaluate 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.
	Nutrient Cycles*1	Carbon cycle reminder from GCSE including production of compost; nitrogen cycle including the bacteria involved; phosphorous cycle; natural and artificial fertilisers; eutrophication, indicator species.	Identify soil invertebrates using a key; aseptic technique; writing risk assessments; essay skills in Biology.
	Responses for Survival	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	Contributions of many scientists to our understanding of plant hormones; identifying and controlling control variables; risk assessments; Student's T test; standard deviation; percentage change; writing conclusions and

		nothing principle of action potentials; the refractory period.	evaluations; opportunity to meet all CPACs in RP10.
	Receptors to Effectors	Generator potentials; Pacinian corpuscles; rods and cones in the eye and the structure of the retina; control of heart rate involving chemoreceptors and baroreceptors; structure and function of synapses; the effect of drugs on synapse function.	Dissection skills; using sharp instruments safely; presenting skills; selecting sources and assessing their reliability when researching different examples of drugs which affect synapses.
	Muscles*[1]	Macro and micro structure of muscle; neuromuscular junctions; mechanism of muscle contraction; slow and fast twitch muscle fibres.	Using microscopes with oil immersion lenses; drawing biological images; modelling muscle function and analysing models.
	Homeostasis	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.	Presentation skills; 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.
Y13 Teacher B	**Ecology Recap**	Review of Y12 Populations in Ecosystems topic post Fieldwork Course.	Review of Y12 Populations in Ecosystems topic post Fieldwork Course.
	Nutrient Cycles*[1]	Carbon cycle reminder from GCSE including production of compost; nitrogen cycle including the bacteria involved; phosphorous cycle; natural and artificial fertilisers; eutrophication, indicator species.	Identify soil invertebrates using a key; aseptic technique; writing risk assessments; essay skills in Biology.
	Inheritance	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	Drawing genetic diagrams; interpreting pedigree diagrams; chi^2 statistical test; use the Hardy-Weinberg calculation.

		and sympatric speciation; genetic drift.	
	Respiration	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.	Using respirometers; working safely and ethically with living organisms; modelling respiration and evaluating these models; comparing respiration and photosynthesis; essay skills in Biology; opportunity to meet all (except 2a+b) CPACs in RP measuring the rate of respiration in yeast cells using dehydrogenase.
	Muscles*1	Macro and micro structure of muscle; neuromuscular junctions; mechanism of muscle contraction; slow and fast twitch muscle fibres.	Using microscopes with oil immersion lenses; drawing biological images; modelling muscle function and analysing models.
	Gene Expression and Technology	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.	Aseptic technique; using sharp instruments safely; 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.

*1 These topics are taught once, by whichever teacher has the rotation lesson on their timetable.

*2 This topic is split between teachers A and B to ensure its completion prior to the field course.