Topic 1	Red	Amber	Green
Understand why many animals have a heart and circulation (mass transport to overcome limitations of diffusion).			
Understand the importance of water as a solvent in transport, including its dipole nature.			
Understand how the structure of blood vessels (capillaries, arteries and veins) relate to their function.			
Know the cardiac cycle (atrial systole, ventricular systole and cardiac diastole) and relate the structure and operation of the mammalian heart including the major blood vessels to its function.			
Know how the relationship between heart structure and function can be investigated practically.			
Understand the course of events that lead up to atherosclerosis (endothelial dysfunction, inflammatory response, plaque formation, raised blood pressure.)			
Understand the blood clotting process and its role in cardiovascular disease.			
Know how factors (age, genetic, diet, high blood pressure, smoking, and inactivity) increase the risk of cardiovascular disease.			
Be able to analyse and interpret quantitative data on illness and mortality rates to determine health risks (including distinguishing between correlation and causation and recognising conflicting evidence).			
Be able to evaluate the design of studies used to determine health risk factors (including sample selection and sample size).			
Understand why peoples perceptions of risk are often different from the actual risk (including under and over estimating the risk due to diet and other lifestyle factors).			
Be able to analyse the data on energy budgets and diet.			
Understand the consequences of energy imbalance, including weight loss, weight gain and development of obesity.			
Know the difference between monosaccharides, disaccharides and polysaccharides e.g. glycogen and starch			

(amylose/amylopectin).			
Relate the structures of monosaccharides, disaccharides and polysaccharides to their roles in providing and storing energy.			
Know how monosaccharides join to form disaccharides (sucrose, lactose and maltose) and polysaccharides (glycogen and amylose) through condensation reactions forming glycosidic bonds and how these can be split in hydrolysis reactions.			
Know how a triglyceride in synthesised by the formation of ester bonds during condensation reactions between glycerol and 3 fatty acids.			
Know the difference between saturated and unsaturated fatty acids.			
Be able to analyse and interpret data on the possible significance for health and blood cholesterol levels and levels of high LDLs and HDLs			
Know the evidence for a casual relationship between blood cholesterol levels total cholesterol and LDL cholesterol and cardiovascular disease.			
Understand how people use scientific knowledge about the effects of diet (including obesity indicators body mass index and waist to hip ratio) exercise and smoking to reduce their risk of coronary heart disease.			
Be able to investigate the effect of caffeine on heart rate in daphnia.			
Be able to discuss the potential ethical issues regarding the use of invertebrates in research.			
Be able to investigate the vitamin C content in food and drink.			
Know the benefits and risk of treatment for CVD (antihypertensive, statins, anticoagulants and platelet inhibitors.)			

Topic 2	After lesson	After revision	After assessment
Know the properties of gas exchange surfaces in living organisms			
Understand how the rate of diffusion is dependent on these properties and can be calculated using Fick's Law.			
Understand how the mammalian lung is adapted for gas exchange.			
Know the structure and properties of cell membranes.			
Understand how models such as the fluid mosaic model are used to develop scientific understanding.			
Be able to investigate the membrane structure e.g. the effect of alcohol concentration or temperature on membrane permeability.			
Understand what is meant by osmosis in terms of the movement of free water molecules through a partially permeable membrane.			
Understand what is meant by passive transport (diffusion/ facilitated diffusion), active transport (including the role of ATP as an immediate source of energy), endocytosis, exocytosis, carrier and channel proteins.			
Know the structure of amino acids.			
Understand the formation of polypeptides and proteins (as amino acid monomers linked by peptide bonds through condensation reactions.)			
Understand the significance of the proteins primary structure in determining its 3D structure and properties.			
Know the molecular structure of globular and fibrous proteins and the type of bonds involved in the 3D structure).			
Be able to relate the molecular structure of globular and fibrous proteins to their functions (including haemoglobin and collagen)			
Understand the mechanism of action and specificity of enzymes in terms of their 3D structure.			
Understand that enzymes are biological catalysts that reduce activation energy.			
Know that there are intracellular enzymes catalysing reactions inside cells and extracellular enzymes produced by cells catalysing reactions outside of cells.			
Be able to investigate the effect of enzyme concentration on rates of reactions.			

Be able to calculate the initial rate of reaction.			
Know the basic structure of mononucleotides and the structures of DNA and RNA (as polynucleotides composed of mononucleotides linked through condensation reactions.)			
Know how complementary base pairing and the H bonding between 2 complementary strands are involved in the formation of the DNA double helix.			
Understand the nature of the genetic code (triplet code, non-overlapping, degenerate).			
Know that a gene is a sequence of bases on a DNA molecule that codes for a sequence of amino acids on a polypeptide chain.			
Understand the process of DNA replication.			
Understand how Meselson and Stahl's experiment provided new data that supported the accepted theory of replication of DNA and refuted competing theories.			
Understand how errors in DNA replication can give rise to mutations.			
Understand how cystic fibrosis results from one of a number of possible gene mutations.			
Know the meanings of the terms gene, allele, genotype, phenotype, recessive, dominant, incomplete dominance, homozygote, heterozygote.			
Understand patterns of inheritance, including the interpretation of genetic pedigree diagrams, in the context of monohybrid inheritance.			
Understand how the expression of a gene mutation in people with CF impairs the functioning of the gaseous exchange, digestive and reproductive systems.			
Understand the uses of genetic screening, including the identification of carriers, pre-implantation genetic diagnosis (PGD) and prenatal testing.			
Understand the implications of prenatal screening.			
Be able to identify and discuss the social and ethical issues related to genetic screening from a range of ethical viewpoints.			

Topic 3	Red
Know that all living organisms are made from cells, sharing some common features.	
Know the ultrastructure of an animal (eukaryotic) cell (nucleus, nucleolus, ribosomes, rough and smooth endoplasmic reticulum, mitochondria, centrioles, lysosomes, and Golgi apparatus.)	
Be able to recognise these organelles from electron microscope images.	
Understand the role of the rough endoplasmic reticulum and the Golgi apparatus in protein transport within cells, including their role in the formation of extracellular enzymes.	
Be able to distinguish between eukaryotic and prokaryotic cells in terms of their structure and ultra structure.	
Understand how mammalian gametes are specialised for their function (including the acrosome in sperm and the zona pellucida in the egg).	
Know the process of fertilisation in mammals, including the acrosome reaction, the cortical reaction and the fusion of the nuclei.	
Understand the importance of fertilisation in sexual reproduction.	
Know that a locus (loci) is the location of genes on a chromosome.	
Understand the linkage of genes on a chromosome and sex linkage.	
Understand the role of meiosis in the production of gametes and in increasing genetic variation though independent assortment of chromosomes and by crossing over of alleles between chromatids.	
Understand the role of mitosis and the cell cycle for growth and asexual reproduction.	
Understand how to prepare and stain a root tip squash to observe the stages of mitosis.	
Understand what is meant by the terms ‘stem cell, pluripotency and totipotency;	
Be able to discuss the way society uses scientific knowledge to make decisions about the use of stem cells in medical therapies.	
Understand how cells become specialised through differential gene expression, producing active mRNA leading to synthesis of proteins, which in turn control cell processes or determine cell structure.	

Understand why cells of multicellular organisms are organised into tissues, tissues into organs and organs into systems.	
Understand how phenotype is the result of an interaction between genotype and the environment.	
Know how epigenetic changes (i.e. DNA methylation and histone modification) can modify the activation of certain genes and explain how these changes can be passed on following cell division.	
Understand how some phenotypes are affected by multiple alleles for the same gen at many loci (polygenic inheritance) as well as the environment and this can give rise to phenotypes that show continuous variation.	

Topic 4	Red	Amber	Green
Understand the terms 'biodiversity' and 'endemism'			
Know how biodiversity can be measured within a habitat using species richness and within a species using genetic diversity (e.g. by calculating the heterozygosity index) and how biodiversity can be compared in different habitats using Simpson's diversity index: $D = \frac{N (N -1)}{\sum n (n – 1)}$			
Understand the concept of niche and discuss examples of adaptation of organisms to their environment (behavioural, physiological and anatomical).			
Understand how natural selection can lead to adaptation and evolution.			
Understand how the Hardy-Weinberg equation can be used to see whether a change in allele frequency is occurring in a population over time.			
Understand the reproductive isolation can lead to accumulation of different genetic information in populations potentially leading to the formation of new species.			
Understand that classification is a means of organising the variety of life based on relationships between organisms using differences and similarities in phenotypes and in genotypes and is built around the concept of a species.			
Understand the process and importance of critical evaluation of new data by the scientific community, which lead to new taxonomic groupings (including the 3 domains of life based on molecular phylogeny).			
Be able to compare the ultrastructure of plant cells (including cell wall, chloroplast, amyloplasts, vacuole, tonoplast, plasmodesmata, pits and middle lamella) with that of animal cells.			
Understand the structure and function of the polysaccharides starch and cellulose, including the roles of hydrogen bonds between B-glucose molecules in the formation of cellulose myofibrils.			
Understand how the arrangement of cellulose micro fibrils and secondary thickening in plant cell walls contributes to the physical properties of the xylem vessels and the sclerenchyma fibres that make up plant fibres that can be exploited by humans.			

Be able to identify sclerenchyma fibres, phloem sieve tubes and xylem vessels and their location within stems through a light microscope.			
Know the similarities and differences between the structures, position in the stem and function of sclerenchyma fibres (support), xylem vessels (support and transport) and phloem (translocation of organic solutes).			
Understand the importance of water and inorganic ions (nitrate, calcium ions and magnesium ions) in plants.			
Understand how to investigate plant mineral deficiencies.			
Be able to determine the tensile strength of plant fibres.			
Understand the development of drug testing from historic to contempory (William Withering's digitalis soup, double blind trials, placebo, 3 phased testing).			
Be able to investigate the antimicrobial properties of plants.			
Understand how the uses of plant fibres and starch may contribute to sustainability (e.g. plant based products to replace oil based plastic).			
Be able to evaluate the methods used by zoos and seed banks in the conservation of endangered species and their genetic diversity (e.g. scientific research, captive breeding, reintroduction programmes and education).			