A level Biology Year 1 Personal Learning Checklist

Paper 1 = Topics 1, and 2

Paper 2 = Topics 3 and 4

Topic 1 Lifestyle, Health and Risk

Objective	Confidence (R/A/G)		
	1	2	3
1.1 Understand why many animals have a heart and circulation (mass transport to overcome limitations of diffusion in meeting the requirements of organisms).			
1.2 Understand the importance of water as a solvent in transport, including its dipole nature.			
1.3 Understand how the structures of blood vessels (capillaries, arteries and veins) relate to their functions.			
1.4 i) 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. ii) Know how the relationship between heart structure and function can be investigated practically.			
1.5 Understand the course of events that leads to atherosclerosis (endothelial dysfunction, inflammatory response, plaque formation, raised blood pressure).			
1.6 Understand the blood-clotting process (thromboplastin release, conversion of prothrombin to thrombin and fibrinogen to fibrin) and its role in cardiovascular disease (CVD).			
1.7 Know how factors such as genetics, diet, age, gender, high blood pressure, smoking and inactivity increase the risk of cardiovascular disease (CVD).			
1.8 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.			
1.9 Be able to evaluate the design of studies used to determine health risk factors, including sample selection and sample size used to collect data that is both valid and reliable.			
1.10 Understand why people's perceptions of risks are often different from the actual risks, including underestimating and overestimating the			

risks due to diet and other lifestyle factors in the development of heart disease.			
1.11 i) Be able to analyse data on energy budgets and diet. ii) Understand the consequences of energy imbalance, including weight loss, weight gain, and development of obesity.			
1.12 i) Know the difference between monosaccharides, disaccharides and polysaccharides, including glycogen and starch (amylose and amylopectin). ii) Be able to relate the structures of monosaccharides, disaccharides and polysaccharides to their roles in providing and storing energy (β-glucose and cellulose are not required in this topic).			
1.13 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 through hydrolysis reactions.			
1.14 i) Know how a triglyceride is synthesised by the formation of ester bonds during condensation reactions between glycerol and three fatty acids. ii) Know the differences between saturated and unsaturated lipids.			
1.15 i) Be able to analyse and interpret data on the possible significance for health of blood cholesterol levels and levels of high-density lipoproteins (HDLs) and low-density lipoproteins (LDLs). ii) Know the evidence for a causal relationship between blood cholesterol levels (total cholesterol and LDL cholesterol) and cardiovascular disease (CVD).			
1.16 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.			
CORE PRACTICAL 1: Investigate the effect of caffeine on heart rate in Daphnia.			
1.17 Be able discuss the potential ethical issues regarding the use of invertebrates in research.			
CORE PRACTICAL 2: Investigate the vitamin C content of food and drink.			
1.18 Know the benefits and risks of treatments for cardiovascular disease			

Topic 2 Genes and Health

Objective	Confidence

	(R/A/G)		
	1	2	3
2.1 i) Know the properties of gas exchange surfaces in living organisms (large surface area to volume ratio, thickness of surface, difference in concentration). ii) Understand how the rate of diffusion is dependent on these properties and can be calculated using Fick's Law of Diffusion. iii) Understand how the structure of the mammalian lung is adapted for rapid gaseous exchange.			
2.2 i) Know the structure and properties of cell membranes. ii) Understand how models such as the fluid mosaic model of cell membranes are interpretations of data used to develop scientific explanations of the structure and properties of cell membranes.			
CORE PRACTICAL 3: Investigate membrane structure, including the effect of alcohol concentration or temperature on membrane permeability.			
2.3 Understand what is meant by osmosis in terms of the movement of free water molecules through a partially permeable membrane (consideration of water potential is not required).			
2.4 i) Understand what is meant by passive transport (diffusion, facilitated diffusion), active transport (including the role of ATP as an immediate source of energy), endocytosis and exocytosis. ii) Understand the involvement of carrier and channel proteins in membrane transport.			
2.5 i) Know the basic structure of mononucleotides (deoxyribose or ribose linked to a phosphate and a base, including thymine, uracil, cytosine, adenine or guanine) and the structures of DNA and RNA (polynucleotides composed of mononucleotides linked through condensation reactions). ii) Know how complementary base pairing and the hydrogen bonding between two complementary strands are involved in the formation of the DNA double helix.			
2.6 i) Understand the process of protein synthesis (transcription) including the role of RNA polymerase, translation, messenger RNA, transfer RNA, ribosomes and the role of start and stop codons. ii) Understand the roles of the DNA template (antisense) strand in transcription, codons on messenger RNA and anticodons on transfer RNA.			
2.7 Understand the nature of the genetic code (triplet code, non-overlapping and degenerate).			
2.8 Know that a gene is a sequence of bases on a DNA molecule that codes for a sequence of amino acids in a polypeptide chain.			

2.9 i) Know the basic structure of an amino acid (structures of specific amino acids are not required). ii) Understand the formation of polypeptides and proteins (amino acid monomers linked by peptide bonds in condensation reactions). iii) Understand the significance of a protein's primary structure in determining its three-dimensional structure and properties (globular and fibrous proteins and the types of bonds involved in its three-dimensional structure). iv) Know the molecular structure of a globular protein and a fibrous protein and understand how their structures relate to their functions (including haemoglobin and collagen).			
2.10 i) Understand the mechanism of action and the specificity of enzymes in terms of their three-dimensional structure. ii) Understand that enzymes are biological catalysts that reduce activation energy. iii) Know that there are intracellular enzymes catalysing reactions inside cells and extracellular enzymes produced by cells catalysing reactions outside of cells.			
CORE PRACTICAL 4: Investigate the effect of enzyme and substrate concentrations on the initial rates of reactions.			
2.11 i) Understand the process of DNA replication, including the role of DNA polymerase. ii) Understand how Meselson and Stahl's classic experiment provided new data that supported the accepted theory of replication of DNA and refuted competing theories.			
2.12 i) Understand how errors in DNA replication can give rise to mutations. ii) Understand how cystic fibrosis results from one of a number of possible gene mutations.			
2.13 i) Know the meaning of the terms: gene, allele, genotype, phenotype, recessive, dominant, incomplete dominance, homozygote and heterozygote. ii) Understand patterns of inheritance, including the interpretation of genetic pedigree diagrams, in the context of monohybrid inheritance.			
2.14 Understand how the expression of a gene mutation in people with cystic fibrosis impairs the functioning of the gaseous exchange, digestive and reproductive systems.			

2.15 i) Understand the uses of genetic screening, including the identification of carriers, pre-implantation genetic diagnosis (PGD) and prenatal testing, including amniocentesis and chorionic villus sampling. ii) Understand the implications of prenatal genetic screening.			
2.16 Be able to identify and discuss the social and ethical issues related to genetic screening from a range of ethical viewpoints.			

Topic 3 Voice of the Genome

Objective	Confidence (R/A/G)		
	1	2	3
3.1 Know that all living organisms are made of cells, sharing some common features.			
3.2 Know the ultrastructure of eukaryotic cells, including nucleus, nucleolus, ribosomes, rough and smooth endoplasmic reticulum, mitochondria, centrioles, lysosomes, and Golgi apparatus.			
3.3 Understand the role of the rough endoplasmic reticulum (rER) and the Golgi apparatus in protein transport within cells, including their role in the formation of extracellular enzymes.			
3.4 Know the ultrastructure of prokaryotic cells, including cell wall, capsule, plasmid, flagellum, pili, ribosomes, mesosomes and circular DNA.			
3.5 Be able to recognise the organelles in 3.2 from electron microscope (EM) images.			
3.6 Understand how mammalian gametes are specialised for their functions (including the acrosome in sperm and the zona pellucida in the egg).			
3.7 Know the process of fertilisation in mammals, including the acrosome reaction, the cortical reaction and the fusion of nuclei.			
3.8 i) Know that a locus (plural = loci) is the location of genes on a chromosome. ii) Understand the linkage of genes on a chromosome and sex linkage.			
3.9 Understand the role of meiosis in ensuring genetic variation through the production of non-identical gametes as a consequence of independent assortment of chromosomes and crossing over of alleles between chromatids (details of the stages of meiosis are not required).			
3.10 Understand the role of mitosis and the cell cycle in producing identical daughter cells for growth and asexual reproduction.			

CORE PRACTICAL 5: Prepare and stain a root tip squash to observe the stages of mitosis.			
3.11 i) Understand what is meant by the terms 'stem cell, pluripotency and totipotency'. ii) Be able to discuss the way society uses scientific knowledge to make decisions about the use of stem cells in medical therapies.			
3.12 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 in animals and plants, including the lac operon.			
3.13 Understand how the cells of multicellular organisms are organised into tissues, tissues into organs and organs into systems.			
3.14 i) Understand how phenotype is the result of an interaction between genotype and the environment. ii) Know how epigenetic changes, including DNA methylation and histone modification, can modify the activation of certain genes. iii) Understand how epigenetic changes can be passed on following cell division.			
3.15 Understand how some phenotypes are affected by multiple alleles for the same gene at many loci (polygenic inheritance) as well as the environment and how this can give rise to phenotypes that show continuous variation.			

Topic 4 Biodiversity and Natural Resources

Objective	Confidence (R/A/G)		
	1	2	3
4.1 Know that over time the variety of life has become extensive but is now being threatened by human activity.			
4.2 i) Understand the terms biodiversity and endemism. ii) Know how biodiversity can be measured within a habitat using species richness and within a species using genetic diversity by calculating the heterozygosity index (H) iii) Understand how biodiversity can be compared in different habitats using a formula to calculate an index of diversity (D)			
4.3 Understand the concept of niche and be able to discuss examples of adaptation of organisms to their environment (behavioural, physiological and anatomical).			

4.4 Understand how natural selection can lead to adaptation and evolution.			
4.5 i) Understand how the Hardy-Weinberg equation can be used to see whether a change in allele frequency is occurring in a population over time. ii) Understand that reproductive isolation can lead to accumulation of different genetic information in populations, potentially leading to the formation of new species.			
4.6 i) 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 species concept. ii) Understand the process and importance of critical evaluation of new data by the scientific community, which leads to new taxonomic groupings, including the three domains of life based on molecular phylogeny, which are Bacteria, Archaea, Eukaryota.			
4.7 Know the ultrastructure of plant cells (cell walls, chloroplasts, amyloplasts, vacuole, tonoplast, plasmodesmata, pits and middle lamella) and be able to compare it with animal cells.			
4.8 Be able to recognise the organelles in 4.7 from electron microscope (EM) images.			
4.9 Understand the structure and function of the polysaccharides starch and cellulose, including the role of hydrogen bonds between β-glucose molecules in the formation of cellulose microfibrils.			
4.10 Understand how the arrangement of cellulose microfibrils and secondary thickening in plant cell walls contributes to the physical properties of xylem vessels and sclerenchyma fibres in plant fibres that can be exploited by humans.			
CORE PRACTICAL 6: Identify sclerenchyma fibres, phloem sieve tubes and xylem vessels and their location within stems through a light microscope.			
4.11 Know the similarities and differences between the structures, position in the stem and function of sclerenchyma fibres (support), xylem vessels (support and transport of water and mineral ions) and phloem (translocation of organic solutes).			
4.12 Understand the importance of water and inorganic ions (nitrate, calcium ions and magnesium ions) to plants.			
CORE PRACTICAL 7: Investigate plant mineral deficiencies.			
CORE PRACTICAL 8: Determine the tensile strength of plant fibres.			

4.13 Understand the development of drug testing from historic to contemporary protocols, including William Withering's digitalis soup, double blind trials, placebo, three-phased testing.			
4.14 Understand the conditions required for bacterial growth.			
CORE PRACTICAL 9: Investigate the antimicrobial properties of plants, including aseptic techniques for the safe handling of bacteria.			
4.15 Understand how the uses of plant fibres and starch may contribute to sustainability, including plant-based products to replace oil-based plastics.			
4.16 Be able to evaluate the methods used by zoos and seed banks in the conservation of endangered species and their genetic diversity, including scientific research, captive breeding programmes, reintroduction programmes and education.			

Key skills

Objective		Confidence (R/A/G)		
		1	2	3
Arithmetic and Numerical Computation	Express numbers in decimal form.			
	Express numbers in standard form.			
	Use ratios, fractions and percentages.			
	Make estimates of the results of simple calculations.			
	Use calculators to find and use power, exponential and logarithmic functions.			
Handling Data	Use an appropriate number of significant figures/			
	Calculate the mean.			
	Understand the terms mean, mode and median.			
	Make order of magnitude calculations.			
	Select and use a statistical test.			
	Understand measures of dispersion, including standard deviation and range.			
Algebra	Understand and use the symbols: =, <, <<, >>, >, $\propto$, ~			
	Change the subject of an equation.			
	Substitute numerical values into equations using appropriate units.			

Graphs	Understand that $y = mx+c$ represents a linear relationship.			
	Plot a line graph from experimental data, including drawing a line of best fit.			
	Determine the gradient and intercept of a linear graph.			
	Draw a tangent to a curve and calculate its gradient as a measure of the rate of change.			
	Identify a correlation from a graph.			
Geometry and Trigonometry	Visualise and represent 2D and 3D forms.			
	Calculate areas of triangles and rectangles.			
	Calculate surface areas and volumes of cubes.			
Data analysis	Describe overall trends and significant changes from data in tables and graphs.			
	Manipulate the data to emphasise trends observed.			
	Draw inferences and conclusions by linking the data to your own biological knowledge.			
Literacy	Identify the meanings of the key words of an exam question.			
	Select the relevant information given in a question to answer it.			
	Answer extended questions strategically.			
	Link the relevant subject knowledge to answer questions on text such as the article in paper 3.			
Practicals	Identify the range of the independent variable required.			
	Identify the equipment required and what will be recorded for the dependent variable.			
	Identify the controlled variables and how they will be kept the same/monitored to ensure validity.			
	Identify how to make the experiment repeatable.			
	Identify any ethical issues.			
	Identify all risks and precautions.			
	Apply your knowledge of the method to new contexts and scenarios.			
	Apply your knowledge of the practical method to comment on and improve the validity and repeatability of a similar method.			
	Evaluate results and draw conclusions with reference to measurement uncertainties and errors.			