KS4 Checklists – GCSE Biology (Separate)
AQA Biology (8461) from 2016

Year 9 Biology Checklist

Italics – Triple only **Bold – Higher only**

Paper 1

B1 Cell biology				
Topic	**Student Checklist**	**R**	**A**	**G**
Cell structure *	Use the terms 'eukaryotic' and 'prokaryotic' to describe types of cells			
	Describe the features of bacterial (prokaryotic) cells			
	Demonstrate an understanding of the scale and size of cells and be able to make order of magnitude calculations, inc standard form			
	Recall the structures found in animal and plant (eukaryotic) cells inc algal cells			
	Use estimations and explain when they should be used to judge the relative size or area of sub-cellular structures			
	Required practical 1: use a light microscope to observe, draw and label a selection of plant and animal cells			
	Describe the functions of the structures in animal and plant (eukaryotic) cells			
	Describe what a specialised cell is, including examples for plants and animals			
	Describe what differentiation is, including differences between animals and plants			
	Define the terms magnification and resolution			
	Compare electron and light microscopes in terms of their magnification and resolution			
	Carry out calculations involving magnification using the formula: magnification = size of image/ size of real object -inc standard form			
Cell division	Describe how genetic information is stored in the nucleus of a cell (inc genes & chromosomes)			
	Describe the processes that happen during the cell cycle, including mitosis (inc recognise and describe where mitosis occurs)			
	Describe stem cells, including sources of stem cells in plants and animals and their roles			
	Describe the use of stem cells in the production of plant clones and therapeutic cloning			
	Discuss the potential risks, benefits and issues with using stem cells in medical research/treatments (inc diabetes and paralysis)			
Transport in cells	Describe the process of diffusion, including examples			
	Explain how diffusion is affected by different factors			
	Define and explain "surface area to volume ratio", and how this relates to single-celled and multicellular organisms (inc calculations)			
	Explain how the effectiveness of an exchange surface can be increased, inc examples of adaptations for small intestines, lungs, gills roots & leaves			
	Describe the process of osmosis (inc calculation of water uptake & percentage gain and loss of mass of plant tissue)			
	Required practical 3: investigate the effect of a range of concentrations of salt or sugar solutions on the mass of plant tissue			
	Describe the process of active transport, including examples - gut and roots			
	Explain the differences between diffusion, osmosis and active transport			

*Culturing microorganisms is taught in year 10

B2 Organisation				
Topic	**Student Checklist**	**R**	**A**	**G**
Principles of organisation & Animal tissues, organs and organ systems	Describe the levels of organisation within living organisms			
	Describe the digestive system and how it works as an organ system (from KS3)			
	Describe basic features of enzymes (inc rate calculations for chemical reactions)			
	Describe the lock and key theory as a model of enzyme action and explain how the shape a of the active sites makes the enzyme specific			
	Explain the effect of temperature and pH on enzymes			
	Describe the digestive enzymes, including their names, sites of production and actions			
	Describe how the products of digestion are used			
	Describe the features and functions of bile and state where it is produced and released from			
	Required practical 4: use qualitative reagents to test for a range of carbohydrates, lipids and proteins			
	Required practical 5: investigate the effect of pH on the rate of reaction of amylase enzyme			
	Describe the structure of the human heart and lungs (inc how lungs are adapted for gaseous exchange)			
	Explain how the heart moves blood around the body (inc role and position of the aorta, vena cava, pulmonary artery & vein and coronary arteries)			
	Explain how the natural resting heart rate is controlled and how irregularities can be corrected			
	Describe the structure and function of arteries, veins and capillaries			
	Use simple compound measures such as rate and carry out rate calculations for blood flow			
	Describe blood and identify its different components, inc identifying blood cells from photographs/diagrams			
	Describe the functions of blood components, including adaptations to function			
	Describe what happens in coronary heart disease and what statins are used for			
	Describe and evaluate treatments for coronary heart disease and heart failure (inc drugs, mechanical devices or transplant)			
	Recall that heart valves can become faulty and describe the consequences of this			
	Describe how patients can be treated in the case of heart failure			
	Describe health and the explain causes of ill-health and the relationship between health and disease			
	Describe how different types of diseases may interact and translate disease incidence information between graphical and numerical forms			
	Describe what risk factors are and give examples discussing human and financial costs of non-communicable diseases at local, national and global levels			
	Describe what cancer is and explain the difference between benign and malignant tumours			
	Describe the known risk factors for cancer, including genetic and lifestyle risk factors			
Plant tissues, organs and system	Describe plant tissues (epidermal, palisade mesophyll, spongy mesophyll, xylem, phloem and meristem) and describe their functions			
	Explain how the structure of plant tissues are related to their function within the leaf (plant organ) inc stomata and guard cells			
	Recall the plant parts that form a plant organ system that transports substances around the plant			
	Explain how root hair cells, xylem and phloem are adapted to their functions			
	Describe the process of transpiration and translocation including the role of the different plant tissues			
	Explain how the rate of transpiration can be affected by different factors (inc naming the factors)			
	Describe the role of stomata and guard cells in the control of gas exchange and water loss			

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B3 Infection and response				
Topic	**Student Checklist**	**R**	**A**	**G**
Communicable diseases	Explain what a pathogen is and how pathogens are spread (inc how viruses, bacteria, protists and fungi are spread in animals and plants)			
	Explain how pathogenic bacteria and viruses cause damage in the body			
	Explain how the spread of diseases can be reduced or prevented			
	Describe measles, HIV and tobacco mosaic virus as examples of viral pathogens			
	Describe salmonella food poisoning and gonorrhoea as examples of bacterial pathogens			
	Describe the signs, transmission and treatment of rose black spot infection in plants as an example of fungal pathogens			
	Describe the symptoms, transmission and control of malaria, including knowledge of the mosquito vector as an example of a protists pathogen			
	Describe defences that stop pathogens entering the human body (inc skin, nose, trachea & windpipe, stomach)			
	Recall the role of the immune system			
	Describe how white blood cells destroy pathogens			
	Describe how vaccination works, including at the population level			
	Explain how antibiotics and painkillers are used to treat diseases, including their limitations			
	Describe how sources for drugs have changed over time and give some examples			
	Describe how new drugs are tested, including pre-clinical testing and clinical trials (inc double blind trials and placebos)			
B1 Culturing microorganisms	*Bio ONLY: Describe how bacteria reproduce and the conditions required*			
	Bio ONLY: Describe how to prepare an uncontaminated culture			
	Bio ONLY: Calculate cross-sectional areas of colonies or clear areas around colonies using πr^2			
	Bio ONLY: Calculate the number of bacteria in a population after a certain time if given the mean division time			
	Express answers for last two points in standard form			
	Required practical 2: investigate the effect of antiseptics or antibiotics on bacterial growth using agar plates and measuring zones of inhibition			
Monoclonal antibodies	***Describe what monoclonal antibodies are and why they are useful***			
	Describe how monoclonal antibodies are produced			
	Explain how monoclonal antibodies are used for diagnosis, research, chemical testing and disease treatments			
	Evaluate the advantages and disadvantages of monoclonal antibodies (inc side effects)			
	Describe some observable signs of plant disease, and how plant diseases can be identified			
Plant disease	*Give examples of plant pathogens*			
	Give examples of plant ion deficiencies and their effects			
	Describe physical, chemical and mechanical defence responses of plants			

Paper 1

B4 Bioenergetics				
Topic	**Student Checklist**	**R**	**A**	**G**
Photosynthesis	Describe what happens in photosynthesis, including using a word equation and recognise the chemical formulas for carbon dioxide, water, oxygen & glucose			
	Explain why photosynthesis is an endothermic reaction			
	Recall the limiting factors of photosynthesis			
	Explain how limiting factors affect the rate of photosynthesis, including graphical interpretation (limited to one factor)			
	Explain how the limiting factors of photosynthesis interact, inc graphical interpretation (two/three factors)			
	Explain how limiting factors are important to the economics of greenhouses, including data interpretation			
	Explain and use inverse proportion in the context of photosynthesis			
	Required practical 6: investigate the effect of light intensity on the rate of photosynthesis using an aquatic organism such as pondweed			
	Describe how the glucose produced in photosynthesis is used by plants			
Respiration	Describe what happens in respiration including using a word equation and recognise the chemical formulas for carbon dioxide, water, oxygen & glucose			
	Describe aerobic and anaerobic respiration with regard to the need for oxygen, the differing products and the relative amounts of energy transferred			
	Recognise the equations for aerobic respiration, anaerobic respiration in muscles and anaerobic respiration in plants and yeast cells.			
	Recall what type of respiration fermentation is and its economic importance.			
	Describe what happens to heart rate, breathing rate and breath volume during exercise and why these changes occur			
	Explain what happens when muscles do not have enough oxygen and define the term oxygen debt			
	Explain what happens to accumulated lactic acid in the body			
	Explain the importance of sugars, amino acids, fatty acids and glycerol in the synthesis and breakdown of carbohydrates, proteins and lipids			
	Explain what metabolism is, including examples			

Paper 2

B5 Homeostasis and response				
Topic	**Student Checklist**	**R**	**A**	**G**
Homeostasis	Describe what homeostasis is and why it is important stating specific examples from the human body			
	Describe the common features of all control systems			
The human nervous system	State the function of the nervous system and name its important components			
	Describe how information passes through the nervous system			
	Describe what happens in a reflex action and why reflex actions are important			
	Explain how features of the nervous system are adapted to their function, including a reflex arc (inc all types of neurone and the synapse)			
	Required practical 7: plan and carry out an investigation into the effect of a factor on human reaction time			
	State the function of the brain and how it is structured, including identifying he cerebral cortex, cerebellum and medulla on a diagram of the brain			
	Describe the functions of different regions of the brain			
	Explain how neuroscientists have been able to map regions of the brain to particular functions			
	State the function of the eye and how it is structured, including names of specific parts			
	Describe the functions of different parts of the eye, including relating structure to function			
	Describe what accommodation is, and how it is carried out			
	Explain what myopia and hyperopia are and how they are treated, including interpreting ray diagrams			
	Describe how body temperature is monitored and controlled			
	Explain how the body's responses act to raise or lower temperature in a given context			
Hormonal coordination in humans	Describe the endocrine system, including the location of the pituitary, pancreas, thyroid, adrenal gland, ovary and testis and the role of hormones			
	State that blood glucose concentration is monitored and controlled by the pancreas			
	Describe the body's response when blood glucose concentration is too high			
	Explain what type 1 and type 2 diabetes are and how they are treated			
	Describe the body's response when blood glucose concentration is too low			
	Explain how glucagon interacts with insulin to control blood glucose levels in the body			
	Describe how water, ions and urea are lost from the body			
	Describe the consequences of losing or gaining too much water for body cells			
	Recall that protein digestion leads to excess amino acids inside the body and describe what happens to these			
	Describe how the kidneys produce urine			
	Describe the effect of ADH on the permeability of the kidney tubules and explain how the water level in the body is controlled by ADH			
	Describe how kidney failure can be treated by organ transplant or dialysis and recall the basic principles of dialysis			
	Describe what happens at puberty in males and females, inc knowledge of reproductive hormones			
	Describe the roles of the hormones involved in the menstrual cycle (FSH, LH and oestrogen)			
	Explain how the different hormones interact to control the menstrual cycle and ovulation			
	Describe how fertility can be controlled by hormonal and non-hormonal methods of contraception (giving specific examples from the spec)			
	Explain how hormones are used to treat infertility, inc the steps in IVF			
	Evaluate the risks and benefits of fertility treatments			
	Describe the functions of adrenaline and thyroxine in the body, and recall where they are produced			
	Explain the roles of thyroxine and adrenaline in the body as negative feedback systems			

4 Plant hormones	*Describe hormone-linked plant responses, to include phototropism and gravitropism and the role of auxin*			
	Describe the functions of gibberellins and ethene in plants			
	Required practical 8: investigate the effect of light or gravity on the growth of newly germinated seedling			
	Explain the use of plant growth hormones are used in agriculture and horticulture (auxins, ethene and gibberellins)			

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Paper 2

B6 Inheritance, variation and evolution				
Topic	**Student Checklist**	**R**	**A**	**G**
Reproduction	Describe features of sexual and asexual reproduction			
	Describe what happens during meiosis and compare to mitosis			
	Describe what happens at fertilisation			
	Explain advantages of sexual and asexual reproduction			
	Describe examples of organisms that reproduce both sexually and asexually (malarial parasites, fungi, strawberry plants and daffodils)			
	Describe the structure of DNA and its role in storing genetic information inside the cell			
	Explain the term 'genome' and the importance of the human genome (specific examples from spec only)			
	Describe the structure of DNA, including knowledge of nucleotide units			
	Explain complementary base pairing in DNA			
	Explain the relationship between DNA bases (ATCG), amino acids and proteins			
	Describe how proteins are synthesised on ribosomes, including protein folding and its importance for protein function			
	Explain what mutations are, and the possible effects of mutations			
	Explain what non-coding parts of DNA are, and why they are important			
	Describe how characteristics are controlled by one or more genes, including examples			
	Explain important genetic terms: gamete, chromosome, gene, allele, genotype, phenotype, dominant, recessive, homozygous and heterozygous			
	Explain and use Punnet square diagrams, genetic crosses and family trees			
	Construct Punnet square diagrams to predict the outcomes of a monohybrid cross			
	Describe cystic fibrosis and polydactyly as examples of inherited disorders			
	Evaluate social, economic and ethical issues concerning embryo screening when given appropriate information			
	Describe how the chromosomes are arranged in human body cells, including the function of the sex chromosomes			
	Explain how sex is determined and carry out a genetic cross to show sex inheritance			
Variation and evolution	Describe what variation is and how it can be caused within a population			
	Describe mutations and explain their influence on phenotype and changes in a species			
	Explain the theory of evolution by natural selection			
	Describe how new species can be formed			
	Describe what selective breeding is			
	Explain the process of selective breeding, including examples of desired characteristics and risks associated with selective breeding			
	Describe what genetic engineering is, including examples, and how it is carried out			
	Explain some benefits, risks and concerns related to genetic engineering			
	Explain the process of genetic engineering, to include knowledge of enzymes and vectors			
	Describe different cloning techniques, to include: tissue culture, cuttings, embryo transplants and adult cell cloning			
The development of understanding	*Describe the ideas proposed by Darwin in his theory of natural selection and explain why this theory was only gradually accepted*			
	Describe other inheritance-based theories that existed (apart from the theory of natural selection), and the problems with these theories			
	Describe the work of Alfred Russel Wallace			
	Explain how new species can be formed			

	Describe how our understanding of genetics has developed over time, to include knowledge of Mendel			
	Describe some sources of evidence for evolution			
	Describe what fossils are, how they are formed and what we can learn from them			
	Explain why there are few traces of the early life forms, and the consequences of this in terms of our understanding of how life began			
	Describe some of the causes of extinction			
	Describe how antibiotic-resistant strains of bacteria can arise and spread (inc MRSA)			
	Describe how the emergence of antibiotic-resistant bacteria can be reduced and controlled, to include the limitations of antibiotic development			
Classification	Describe how organisms are named and classified in the Linnaean system			
	Explain how scientific advances have led to the proposal of new models of classification, inc three-domain system			
	Describe and interpret evolutionary trees			

B7 Ecology				
Topic	**Student Checklist**	**R**	**A**	**G**
Adaptations, interdependence and competition	Recall what an ecosystem is			
	Describe which resources animals and plants compete for, and why they do this			
	Explain the terms 'interdependence' and 'stable community'			
	Name some abiotic and biotic factors that affect communities			
	Explain how a change in an abiotic or biotic factor might affect a community			
	Describe structural, behavioural and functional adaptations of organisms			
	Describe what an extremophile is			
Organisation of an ecosystem	Represent the feeding relationships within a community using a food chain and describe these relationships			
	Explain how and why ecologists use quadrats and transects			
	Describe and interpret predator-prey cycles			
	Required practical 9: measure the population size of a common species in a habitat. Use sampling to investigate the effect of one factor on distribution			
	Describe the processes involved in the carbon cycle			
	Describe the processes involved in the water cycle			
	Explain how temperature, water and availability of oxygen affect the rate of decay of biological material			
	Explain how the conditions for decay are optimised by farmers and gardeners, and the reasons for this			
	Describe how methane gas can be produced from decaying materials for use as a fuel			
	Required practical 10: investigate the effect of temperature on the rate of decay of fresh milk by measuring pH change			
	Explain how environmental changes can affect the distribution of species in an ecosystem (temperature, water and atmospheric gases)			
Biodiversity and the effect of human interaction on ecosystems	Describe what biodiversity is, why it is important, and how human activities affect it			
	Describe the impact of human population growth and increased living standards on resource use and waste production			
	Explain how pollution can occur, and the impacts of pollution			
	Describe how humans reduce the amount of land available for other animals and plants			
	Explain the consequences of peat bog destruction			
	Describe what deforestation is and why it has occurred in tropical areas			
	Explain the consequences of deforestation			
	Describe how the composition of the atmosphere is changing, and the impact of this on global warming			
	Describe some biological consequences of global warming			
	Describe both positive and negative human interactions in an ecosystem and explain their impact on biodiversity			
	Describe programmes that aim to reduce the negative effects of humans on ecosystems and biodiversity			
Trophic levels in an ecosystem	*Describe the different trophic levels and use numbers and names to represent them*			
	Describe what decomposers are and what they do			
	Construct pyramids of biomass accurately from data and explain what they represent			
	State how much energy producers absorb from the Sun and how much biomass is transferred			
	Explain how biomass is lost between trophic levels, including the consequences of this and calculate efficiency between trophic levels			
Food production	*Explain the term 'food security' and describe biological factors that threaten it*			
	Explain how the efficiency of food production can be improved			
	Explain the term 'factory farming', including examples, and ethical objections			
	Explain the importance of maintaining fish stocks at a level where breeding continues			
	Explain some methods that can help to conserve fish stocks			
	Describe how modern biotechnology is used in food production, including the fungus Fusarium as an example			
	Describe the uses of genetically modified organisms in insulin and food production			