Curriculum Map Year 13 - Biology

Topic Name	Term	Content / skills developed with link to NC / exam board subject content (if applicable)	Reflection on previous learning	Progress to future learning	Global Citizenship links	Qatar National Identity links
Unit 4 - Topic 5 – Energy Flow, Ecosystems and the Environment **Photosynthesis 5.1-5.8** **Core Practical 10 – Factors affecting the rate of photosynthesis**	**1**	5.1 understand the overall reaction of photosynthesis as requiring energy from light to split apart the strong bonds in water molecules, storing the hydrogen in a fuel (glucose) by combining it with carbon dioxide and releasing oxygen into the atmosphere 5.2 understand how photophosphorylation of ADP requires energy and that hydrolysis of ATP provides an immediate supply of energy for biological processes 5.3 understand the light-dependent reactions of photosynthesis, including how light energy is trapped by exciting electrons in chlorophyll and the role of these electrons in generating ATP, reducing NADP in cyclic and non-cyclic photophosphorylation and producing oxygen through photolysis of water	**IGCSE Photosynthesis Topic** **AS Biological Molecules Topic** **Practical Based Skills**	**Career pathway / Biology related further study**	**PRIDE** **Perseverence** **Responsibility** **Independence** **DedicationEngagement** Prepare for challenge. Developing skills for the future	**Conscious Thinking about the environment**

		5.4 (i) understand the light-independent reactions as reduction of carbon dioxide using the products of the light-dependent reactions (carbon fixation in the Calvin cycle, the role of GP, GALP, RuBP and RUBISCO) (ii) know that the products are simple sugars that are used by plants, animals and other organisms in respiration and the synthesis of new biological molecules (polysaccharides, amino acids, proteins, lipids and nucleic acids) 5.5 understand the structure of chloroplasts in relation to their role in photosynthesis 5.6 understand what is meant by the terms absorption spectrum and action spectrum 5.7 understand that chloroplast pigments can be separated using chromatography and the pigments identified using Rf values 5.8 CORE PRACTICAL 10 Investigate the effects of light intensity, light wavelength, temperature and availability of carbon				

		dioxide on the rate of photosynthesis using a suitable aquatic plant.				
Unit 4 - Topic 5 – Energy Flow, Ecosystems and the Environment **NPP, GPP and Sampling – 5.9.5.14** **CORE PRACTICAL 11 Carry out a study of the ecology of a habitat using quadrats**	**1**	5.9 (i) understand the relationship between gross primary productivity (GPP), net primary productivity (NPP) and plant respiration (R) (ii) be able to calculate net primary productivity 5.10 know how to calculate the efficiency of biomass and energy transfers between trophic levels 5.11 understand what is meant by the terms population, community, habitat and ecosystem 5.12 understand that the numbers and distribution of organisms in a habitat are controlled by biotic and abiotic factors 5.13 understand how the concept of niche accounts for the distribution and abundance of organisms in a habitat 5.14 CORE PRACTICAL 11 Carry out a study of the ecology of a habitat, such as using quadrats and transects to determine the distribution and abundance of organisms, and measuring abiotic factors appropriate to the habitat.	**KS3 and KS4 Ecosystem Topic – Key definitions, Energy transfer, Biotic and abiotic factors, Practical Based Skills**	**Career pathway / Biology related further study**	Prepare for challenge. Developing skills for the future	**Conscious Thinking about the environment and citizenship**
Unit4 - Topic 5 – Energy Flow, Ecosystems and the		5.15 understand the stages of succession from colonisation to the formation of a climax community	**IGCSE – Ecology and the environment (Topic 4)**	**Career pathway / Biology**	**PRIDE Perseverence Responsibility Independence**	**Conscious Thinking about the**

Environment **5.15-5.22 Climate change and sustainable resources 5.22 CORE PRACTICAL 12 Investigate the effects of temperature on the development of organisms**		5.16 understand the different types of evidence for climate change and its causes, including records of carbon dioxide levels, temperature records, pollen in peat bogs and dendrochronology, recognising correlations and causal relationships 5.17 understand the causes of anthropogenic climate change, including the role of greenhouse gases in the greenhouse effect 5.18 understand how knowledge of the carbon cycle can be applied to methods to reduce atmospheric levels of carbon dioxide 5.19 (i) understand that data can be extrapolated to make predictions and that these are used in models of future climate change (ii) understand that models for climate change have limitations 5.20 understand the effects of climate change (changing rainfall patterns and changes in seasonal cycles) on plants and animals (distribution of species, development and lifecycles) 5.21 understand the effect of temperature on the rate of enzyme activity and its impact on plants, animals and microorganisms, to include Q10	**AS Biology Unit 2 Topic 4**	**related further study**	**DedicationEngagement** Prepare for challenge. Developing skills for the future	**environment and citizenship**

		5.22 CORE PRACTICAL 12 Investigate the effects of temperature on the development of organisms (such as seedling growth rate or brine shrimp hatch rates), taking into account the ethical use of organisms.				
Unit4 - Topic 5 – Energy Flow, Ecosystems and the Environment **5.23-5.26 Evolution and speciation**		5.23 understand how evolution (a change in allele frequency) can come about through gene mutation and natural selection 5.24 understand how isolation reduces gene flow between populations, leading to allopatric or sympatric speciation 5.25 understand the way in which scientific conclusions about controversial issues, such as what actions should be taken to reduce climate change, or the degree to which humans are affecting climate change, can sometimes depend on who is reaching the conclusions 5.26 understand how reforestation and the use of sustainable resources, including biofuels, are examples of the effective management of the conflict between human needs and conservation	**IGCSE – Topic 3 Reproduction and Inheritance**	**Career pathway / Biology related further study**	**PRIDE Perseverence Responsibility Independence DedicationEngagement** Prepare for challenge. Developing skills for the future	**Conscious Thinking about the future, citizenship**
Unit 4 Topic 6 – Microbiology, Immunity and Forensics		6.1 understand the principles and techniques involved in culturing microorganisms, using aseptic technique 6.2	**IGCSE Topics 1 and 2 Nature and Variety of living organisms and**	**Career pathway / Biology**	**PRIDE Perseverence Responsibility Independence**	**Conscious Thinking about the environment**

6.1-6.6 immunology and micro biotics 6.4 Core Practical 13		understand the different methods of measuring the growth of microorganisms, as illustrated by cell counts, dilution plating, mass and optical methods (turbidity) 6.3 understand the different phases of a bacterial growth curve (lag phase, exponential phase, stationary phase and death phase) and be able to calculate exponential growth rate constants 6.4 CORE PRACTIAL 13 Investigate the rate of growth of microorganisms in a liquid culture, taking into account the safe and ethical use of organisms. 6.5 (i) be able to compare the structure of bacteria and viruses (nucleic acid, capsid structure and envelope) with reference to Ebola virus, tobacco mosaic virus (TMV), human immunodeficiency virus (HIV) and lambda phage (λ phage) (ii) understand what is meant by the terms lytic and latency 6.6 understand how Mycobacterium tuberculosis and human immunodeficiency virus (HIV) infect human cells, causing symptoms that may result in death	**structure and function of living organisms**	**related further study**	**DedicationEngagement** Prepare for challenge. Developing skills for the future	**and curiosity, communication, empathy**
Unit 4 Topic 6 – Microbiology, Immunity and Forensics		6.7 (i) know the major routes pathogens may take when entering the body (ii) understand the role of barriers	**IGCSE Topics 1 and 2 Nature and Variety of living organisms and**	**Career pathway / Biology**	**PRIDE Perseverence Responsibility Independence**	**Conscious Thinking about the environment**

6.7-6.15 immunology and antibiotics 6.14 CORE PRACTICAL 14 Investigate the effect of different antibiotics on bacteria.		in protecting the body from infection, including skin, stomach acid, and gut and skin flora 6.8 understand the non-specific responses of the body to infection, including inflammation, lysozyme action, interferon and phagocytosis 6.9 understand the roles of antigens and antibodies in the body's immune response including the involvement of plasma cells, macrophages and antigen-presenting cells 6.10 understand the differences between the roles of B cells (B memory and B effector cells), and T cells (T helper, T killer and T memory cells) in the host's immune response 6.11 understand how individuals may develop immunity (natural, artificial, active and passive) 6.12 understand how the theory of an 'evolutionary race' between pathogens and their hosts is supported by evasion mechanisms shown by pathogens 6.13 understand the difference between bacteriostatic and bactericidal antibiotics 6.14 CORE PRACTICAL 14 Investigate the effect of different antibiotics on bacteria. 6.15 know how an understanding of the contributory causes of hospital-	**structure and function of living organisms**	**related further study**	**DedicationEngagement** Prepare for challenge. Developing skills for the future	**and curiosity, communication, empathy**

		acquired infections has led to codes of practice regarding antibiotic prescription and hospital practice that relate to infection prevention and control				
Unit 4 Topic 6 – Microbiology, Immunity and Forensics **6.16-6.19 PCR, Electrophoresis, and the Carbon cycle**		6.16 know the role of microorganisms in the decomposition of organic matter and the recycling of carbon 6.17 know how DNA can be amplified using the polymerase chain reaction (PCR) 6.18 know how gel electrophoresis can be used to separate DNA fragments of different length 6.19 understand how DNA profiling is used for identification and determining genetic relationships between organisms (plants and animals) 6.20 understand how to determine the time of death of a mammal by examining the extent of decomposition, stage of succession, forensic entomology, body temperature and degree of muscle contraction	**ICGSE – Topic 1-5 Bacteria, Decomposers. WBCs Carbon Cycle**	**Career pathway / Biology related further study**	**PRIDE Perseverence Responsibility Independence DedicationEngagement** Prepare for challenge. Developing skills for the future	**Conscious thinking** about my **Health**
Topic 7 – Respiration, Muscles and the Internal Environment **7.1-7.78 Respiration 7.7 CORE PRACTICAL 15 Use an artificial hydrogen carrier**		7.1 (i) understand the overall reaction of aerobic respiration as splitting of the respiratory substrate to release carbon dioxide as a waste product and reuniting hydrogen with atmospheric oxygen with the release of large amounts of energy (ii) understand that	**IGCSE – Topic 2 Respiration**	**Career pathway / Biology related further study**	**PRIDE Perseverence Responsibility Independence DedicationEngagement** Prepare for challenge.	**Conscious thinking** about my **Health**

(redox indicator) to investigate respiration in yeast. 7.8 CORE PRACTICAL 16 Use a simple respirometer to determine the rate of respiration and RQ of a suitable material (such as germinating seeds or small invertebrates).		respiration is a stepped process, with each step controlled and catalysed by a specific intracellular enzyme Names of specific enzymes are not required. 7.2 understand the roles of glycolysis in aerobic and anaerobic respiration, including the phosphorylation of hexoses, the production of ATP by substrate level phosphorylation, reduced coenzyme, pyruvate and lactate Details of intermediate stages and compounds are not required. 7.3 understand the role of the link reaction and the Krebs cycle in the complete oxidation of glucose and formation of carbon dioxide (CO_2) by decarboxylation, ATP by substrate level phosphorylation, reduced NAD and reduced FAD by dehydrogenation (names of other compounds are not required) and that these steps take place in mitochondria, unlike glycolysis which occurs in the cytoplasm 7.4 understand how ATP is synthesised by oxidative phosphorylation associated with the electron transport chain in mitochondria, including the role of chemiosmosis and ATP synthase			Developing skills for the future	

		7.5 understand what happens to lactate after a period of anaerobic respiration in animals 7.6 understand what is meant by the term respiratory quotient (RQ) 7.7 CORE PRACTICAL 15 Use an artificial hydrogen carrier (redox indicator) to investigate respiration in yeast. 7.8 CORE PRACTICAL 16 Use a simple respirometer to determine the rate of respiration and RQ of a suitable material (such as germinating seeds or small invertebrates).				
Topic 7 – Respiration, Muscles and the Internal Environment**7.9-7.11 Skeletal Muscles and Movement**		7.9 know the way in which muscles, tendons, the skeleton and ligaments interact to enable movement, including antagonistic muscle pairs, extensors and flexors 7.10 (i) know the structure of a mammalian skeletal muscle fibre (ii) understand the structural and physiological differences between fast and slow twitch muscle fibres 7.11 understand the process of contraction of skeletal muscle in terms of the sliding filament theory, including the role of actin, myosin, troponin, tropomyosin, calcium ions (Ca2+), ATP and ATPase	**KS3 – The skeletal and muscular systems** **GCSE – Topic 2 Respiration**	**Career pathway / Biology related further study**	**PRIDE** **Perseverence** **Responsibility** **Independence** **DedicationEngagement**	**Conscious thinking** about my **Health**

Topic 7 – Respiration, Muscles and the Internal Environment **7.12-7.15 Heart and control of the heartbeat** **CORE PRACTICAL 17: Investigate the effects of exercise on tidal volume**		7.12 (i) know the myogenic nature of cardiac muscle (ii) understand how the normal electrical activity of the heart coordinates the heartbeat, including the roles of the sinoatrial node (SAN), the atrioventricular node (AVN), the bundle of His and the Purkyne fibres (iii) understand how the use of electrocardiograms (ECGs) can aid in the diagnosis of abnormal heart rhythms 7.13 (i) be able to calculate cardiac output (ii) understand how variations in ventilation and cardiac output enable rapid delivery of oxygen to tissues and the removal of carbon dioxide from them, including how the heart rate and ventilation rate are controlled and the roles of the cardiovascular control centre and the ventilation centre in the medulla oblongata 7.14 understand the role of adrenaline in the fight or flight response 7.15 CORE PRACTICAL 17 Investigate the effects of exercise on tidal volume, breathing rate, respiratory minute ventilation, and oxygen consumption using data from spirometer traces.	**GCSE – Transport in Humans and co-ordination and response Topic 2**	**Career pathway / Biology related further study**	**PRIDE Perseverence Responsibility Independence DedicationEngagement**	**Conscious thinking** about my **Health**

Topic 7 – Respiration, Muscles and the Internal Environment **7.16-7.22 Homeostasis and the kidney**		7.16 (i) understand what is meant by the terms negative feedback and positive feedback control (ii) understand the principle of negative feedback in maintaining systems within narrow limits 7.17 understand what is meant by the term homeostasis and its importance in maintaining the body in a state of dynamic equilibrium during exercise, including the role of the hypothalamus in thermoregulation 7.18 know the gross and microscopic structure of the mammalian kidney 7.19 understand how urea is produced in the liver from excess amino acids (details of the ornithine cycle are not required) and how it is removed from the bloodstream by ultrafiltration 7.20 understand how solutes are selectively reabsorbed in the proximal tubule and how the loop of Henle acts as a countercurrent multiplier to increase the reabsorption of water 7.21 understand how the pituitary gland and osmoreceptors in the hypothalamus, combined with the action of antidiuretic hormone (ADH), bring about negative feedback control of mammalian plasma	**GCSE – Co-ordination and response Topic 2 Inheritance Topic 3**	**Career pathway / Biology related further study**	**PRIDE Perseverence Responsibility Independence DedicationEngagement**	**Conscious thinking** about my **Health**

		concentration and blood volume 7.22 understand how genes can be switched on and off by DNA transcription factors, including the role of peptide hormones acting extracellularly and steroid hormones acting intracellularly				
Unit 5 - Topic 8 – Coordination, Response and Gene Technology**8.1-8.10 Nervous system and habituation**		8.1 know the structure and function of sensory, relay and motor neurones, including Schwann cells and myelination 8.2 understand how the nervous system of organisms can cause effectors to respond to a stimulus 8.3 know the structure and function of a spinal reflex arc, including grey matter and white matter of the spinal cord 8.4 understand how a nerve impulse (action potential) is conducted along an axon, including changes in membrane permeability to sodium and potassium ions 8.5 understand the role of myelination in saltatory conduction 8.6 (i) know the structure and function of synapses in nerve impulse transmission, including the role of neurotransmitters and acetylcholine (ii) understand how the pupil dilates and contracts 8.7 understand how the effects of drugs can be caused by their	**GCSE – Co-ordination and response Topic 2 Inheritance Topic 3**	**Career pathway / Biology related further study**	**PRIDE Perseverence Responsibility Independence DedicationEngagement**	**Conscious thinking** about my **Health**

		influence on nerve impulse transmission, illustrated by nicotine, lidocaine and cobra venom alpha toxin, the use of L-DOPA in the treatment of Parkinson's disease and the action of MDMA (ecstasy) 8.8 understand how the nervous systems of organisms can detect stimuli with reference to rods in the retina of mammals, the roles of rhodopsin, opsin, retinal, sodium ions, cation channels and hyperpolarisation of rod cells in forming action potentials in the optic neurones 8.9 understand what is meant by the term habituation 8.10 know that the mammalian nervous system consists of the central and peripheral nervous systems				
Unit 5 - Topic 8 – Coordination, Response and Gene Technology **8.11-8.12 Plant responses and core practical investigating the production of amylase in germinating seeds**		8.11 understand how phytochrome, auxin (IAA) and gibberellins bring about responses in plants, including their effects on transcription 8.12 CORE PRACTICAL 18 Investigate the production of amylase in germinating cereal grains.	**GCSE – Co-ordination and response Topic 2 Plant Nutrition Topic 2 Inheritance Topic 3**	**Career pathway / Biology related further study**	**PRIDE Perseverence Responsibility Independence DedicationEngagement**	**Conscious Thinking about the environment and curiosity, communication,**

Unit 5 - Topic 8 – Coordination, Response and Gene Technology **8.13-8.16 The brain and brain disorders (Parkinson's etc.)**		8.13 understand how coordination in animals is brought about through nervous and hormonal control 8.14 know the location and main functions of the cerebral hemispheres, hypothalamus, pituitary gland, cerebellum and medulla oblongata of the human brain 8.15 understand how magnetic resonance imaging (MRI), functional magnetic resonance imaging (fMRI), positron emission tomography (PET) and computed tomography (CT) are used in medical diagnosis and the investigation of brain structure and function 8.16 understand how imbalances in certain naturally-occurring brain chemicals can contribute to ill health, including dopamine in Parkinson's disease and serotonin in depression, and to the development of new drugs		**Career pathway / Biology related further study**	**PRIDE** **Perseverence** **Responsibility** **Independence** **DedicationEngagement**	**Conscious Thinking about the environment and curiosity, communication, Empathy**
Unit 5 - Topic 8 – Coordination, Response and Gene Technology **8.17-8.22 GM responses and microarrays.**		8.17 know how drugs can be produced using genetically modified organisms (plants, animals and microorganisms) 8.18 understand how recombinant DNA can be produced, including the roles of restriction endonucleases and DNA ligase		**Career pathway / Biology related further study**	**PRIDE** **Perseverence** **Responsibility** **Independence** **DedicationEngagement** Prepare for challenge. Developing skills for the future	**Conscious Thinking about the environment and curiosity**

		8.19 understand how recombinant DNA can be inserted into other cells 8.20 know how microarrays can be used to identify active genes 8.21 understand what is meant by the term bioinformatics 8.22 understand the risks and benefits associated with the use of genetically modified organisms				