Diploma Program Outline (2025-2027)

Biology SL and HL

Week	Week of…	Topic / Unit / Text	Content / Skill Development	Graded Assessments
Year 1 Semester 1				
1	**August 18**	Introduction	Introduction, IB Biology curriculum overview Prior knowledge provocation	
2	**August 25**			
3	**September 2**	A1.1 Water	In-depth exploration of water's unique properties (polarity, hydrogen bonding, cohesion/adhesion, high specific heat, high heat of vaporization) and how these properties support living processes such as solvent roles, transport, temperature regulation, and biochemical reactions; often includes quantitative aspects like pH, buffering, and water potential.	Practice exam style questions on topic A1.1 Kongity formative
4	**September 8**	**LAB** A1.2 Nucleic acid	LAB: investigating the cohesive and adhesive properties of water Introduction to macromolecules: The elements found across all biological molecules (CHO) and the four major biological molecules. Detailed study of the structure and function of DNA and RNA, including base pairing, nucleotide composition, double-helix stability, replication and transcription basics, and the role of nucleic acids in heredity and protein synthesis, with occasional emphasis on regulatory sequences and gene expression. Skills: rules in drawing biological diagrams.	Class test: nucleic acids and water diagrams. Class test: exam style practice questions on A1.1 and A1.2.
5	**September 15**	A1.2 Nucleic acids	Detailed study of the structure and function of DNA and RNA, including base pairing, nucleotide composition, double-helix stability, replication and transcription basics, and the role of nucleic acids in heredity and protein synthesis, with occasional emphasis on regulatory sequences and gene expression.	Exam style practice questions on A1.2
6	**September 22**	D1.2 Protein synthesis (SL)	Students learn the central dogma steps—transcription of DNA into mRNA and translation of mRNA into polypeptides—along with the roles of ribosomes, tRNA, codons, and basic post-translational considerations Explaining the process of transcription.	Summative assessment paper 1 style questions on A1.1 and A1.2 Class test: transcription
7	**September 29**	**National Holiday**		
8	**October 6**	D1.2 Protein synthesis (SL)	Students learn the central dogma steps—transcription of DNA into mRNA and translation of mRNA into polypeptides—along with the roles of ribosomes, tRNA, codons, and basic post-translational considerations Explaining the process of translation	Exam style questions Class tests: translation
9	**October 13**	B1.2 Protein	The monomers of proteins and the process of protein synthesis. The various structures (primary, secondary, tertiary and quaternary) of protein. Different functions of proteins.	Essay: How do molecules like water, nucleic acids and protein add to the concept of unity and diversity. Class test: Fluid mosaic model
10	**October 20**	Essay	Effect of malnutrition (carbohydrates, lipids, protein, vitamins and minerals) on the human body.	**Summative assessment: Topics: A1.1; A1.2; D1.2**
11	**October 27**	B1.2 Protein	Detailed study of amino acids, peptide bonds, protein structure levels (primary to quaternary), enzyme function, and protein synthesis/ turnover; integration with metabolism, transport, immune function, and cell signalling, plus kinetics and regulation where applicable. **Mini IA**	Essay: The effect of an increase in CO_2 levels on aquatic ecosystems.
12	**November 3**	B1.1 Lipids	In-depth exploration of lipid structure–function relationships, triglycerides, phospholipids, and cholesterol; topics include digestion, metabolism, energy storage, membrane structure, and signalling roles with quantitative aspects (e.g., energy yield, enzymatic breakdown).	Mini IA methodical design: factors affecting enzyme activity.

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13	**November 10**	B1.1 Carbohydrates	In-depth exploration of carbohydrate structure–function relationships, including monosaccharides, disaccharides, polysaccharides; topics include digestion, metabolism, energy storage, membrane structure, and signalling roles with quantitative aspects (e.g., energy yield, enzymatic breakdown).	Food test lab Essay: malnutrition Formative assessment: Macromolecules (A1.2 ; B1.1 ; B1.2)
14	**November 17**	A2.1 Origin of cells (HL) A2.3 Viruses	Investigate different theories on how life originated by reading various case studies and articles. Examination of the origin of cells and life, including hypotheses like abiogenesis, evidence for LUCA, and the evolution of cellular membranes and organelles, with emphasis on experimental and observational support. Conceptual understanding of viruses as non-cellular, obligate parasites with diverse structures and replication strategies; discussion of viral life cycles, host range, and the distinctions between lytic and lysogenic cycles, plus basic impact on health and ecosystems.	Exam style questions. Summative: Biological molecules (A1.2 ; B1.1 ; B1.2)
15	**November 24**	**Week Without Wall**		
16	**December 1**	A2.2 Cell structure	In-depth study of prokaryotic and eukaryotic cell structures, membrane organization, organelle functions, and the relationship between structure and function. Topics typically include the plasma membrane, cell walls (where present), nucleus, ribosomes, mitochondria, chloroplasts, endoplasmic reticulum, Golgi apparatus, lysosomes, cytoskeleton, and vesicular transport, with emphasis on microscopy techniques and the evidence supporting the cell theory.	Class test: all A2.2 content.
17	**December 8**	A2.2 Skills week	Skills: • making temporary mounts of cells and tissues, staining, measuring sizes using an eyepiece graticule, focusing with coarse and fine adjustments, calculating actual size and magnification, producing a scale bar and taking photographs. • identify cells in light and electron micrographs as prokaryote, plant or animal. In electron micrographs, students should be able to identify these structures: nucleoid region, prokaryotic cell wall, nucleus, mitochondrion, chloroplast, sap vacuole, Golgi apparatus, rough and smooth endoplasmic reticulum, chromosomes, ribosomes, cell wall, plasma membrane and microvilli. • identify cells in light and electron micrographs as prokaryote, plant or animal. In electron micrographs, students should be able to identify these structures: nucleoid region, prokaryotic cell wall, nucleus, mitochondrion, chloroplast, sap vacuole, Golgi apparatus, rough and smooth endoplasmic reticulum, chromosomes, ribosomes, cell wall, plasma membrane and microvilli. • draw and annotate diagrams of organelles as well as other cell structures shown in electron micrographs. Students are required to include the functions in their annotations.	Lab practical: • Working with microscopes • Calculating magnification • Drawing and annotating diagrams of plant, animal, protist and bacteria cells. • Identifying cell structures in electron micrographs.
18	**December 15**	B2.2	Function of membrane bound organelles. Advantages of compartmentalization	Formative assessment: A2.2
19	**December 22**	Christmas & New Year		
20	**December 30**	Christmas & New Year		
21	**January 5**	A3.1 Diversity of organisms	Revision on meiosis as a source of genetic diversity. Revision on mutations as a source of genetic diversity. Broad survey of biological diversity, taxonomy, cladistics, and the unity of life, including examples of major phyla, evolutionary relationships, and the use of phylogenetics to classify organisms. Skills: Students should extract information about genome size for different taxonomic groups from a database to compare genome size to organism complexity.	Summative assessment: A2.2 and B2.2 HL: include A2.1 and A2.3.

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22	**January 12**	A3.2 Classification and cladistics	Skills: develop a dichotomous key, analyzing cladograms, constructing cladograms	Activity: constructing and analysing cladograms.
23	**January 19**	A4.1 Evolution and speciation	Detailed examination of the mechanisms and evidence of evolution, including natural selection, genetic drift, speciation, phylogenetics, fossils, and molecular evidence (DNA and protein comparisons). Focus on how evolutionary change is observed in populations over time and how mathematical models and data interpretation support evolutionary theory.	Exam style practice questions
Year 1 Semester 2				
1	**January 26**	A4.2 Conservation of biodiversity	Exploration of biodiversity, ecosystem services, human impacts on species and habitats, and strategies for conservation. Topics include protected areas, captive breeding, restoration ecology, hotspot concepts, population viability analysis, and ethical, social, and economic considerations in conservation planning.	Exam style practice questions
2	**February 2**	Review Unit 1 Formative assessment	Content tested: A1.1 ; A1.2 ; D1.2 ; B1.2 ; B1.1 ; A2.1 ; A2.2 ; B2.2 ; A2.3 ; A4.1 ; A4.2	Paper 1 and paper 2 style questions
3	**February 9**	Unit 1: Summative assessment B2.1 Membranes and membrane transport D2.3 Water potential	Content tested: A1.1 ; A1.2 ; D1.2 ; B1.2 ; B1.1 ; A2.1 ; A2.2 ; B2.2 ; A2.3 ; A4.1 ; A4.2 Comprehensive look at phospholipid bilayers, membrane proteins, selective permeability, and transport mechanisms (diffusion, osmosis, facilitated diffusion, active transport, endo/exocytosis), including fluid mosaic model and factors affecting permeability. Fluid mosaic model and the selective permeability of the plasma membrane.	Paper 1 and paper 2 style questions
4	**February 16**	**Chinese New Year**		
5	**February 23**	**Chinese New Year**		
6	**March 2**	Mini IA: factors affecting the rate of diffusion.		
7	**March 9**	B2.3 Cell specialization	Mechanisms of cell differentiation, gene regulation during development, stem cells and progenitor cells, and how tissue-specific structures enable specialized function; integration with signaling pathways and homeostasis. Skills: draw and label specialized cells: muscle cells, neurones, red blood cells etc.	Exam style practice questions
8	**March 16**	B3.1 Gas exchange	Advanced understanding of respiratory structures and gas exchange processes across organisms, diffusion principles, partial pressures, and adaptations that maximize gas exchange efficiency. Skills: Students should make measurements to determine tidal volume, vital capacity, and inspiratory and expiratory reserves.	Class tests as review for every lesson: exam style questions
9	**March 23**	B3.2 Transport	Comparative study of transport systems (circulatory or equivalent) across organisms, including cardiovascular structure, circulatory regulation, gas transport, and exchange with tissues; integration with metabolism and homeostasis. Skills: • distinguish arteries and veins in micrographs from the structure of a vessel wall and its thickness relative to the diameter of the lumen. • determine heart rate by feeling the carotid or radial pulse with fingertips. Traditional methods could be compared with digital ones. • evaluate epidemiological data relating to the incidence of coronary heart disease. • interpret systolic and diastolic blood pressure measurements from data and graphs.	Class tests as review for every lesson: exam style questions
10	**March 30**	**B3.2 HL content**	HL: structures of the heart, blood flow in entire circulation. The lymphatic system. Adaptations of xylem and phloem to perform their function. Skills:	Class tests as review for every lesson: exam style questions

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		B3.3 Muscle and mobility	• understand the sequence of events in the left side of the heart that follow the initiation of the heartbeat by the sinoatrial node (the "pacemaker"). • interpret systolic and diastolic blood pressure measurements from data and graphs. Detailed anatomy and physiology of muscle types, excitation–contraction coupling, energy systems for muscle activity, and neuromuscular control, with an emphasis on biomechanics and performance.	
11	**April 6**	**Easter Holiday**		
12	**April 13**	**Organ dissection week: heart, lungs, kidney, muscle** Summative assessment: B3.1 ; B3.2 Humans		
13	**April 20**	B4.1 Adaptation to environment	Range of tolerance affecting the distribution of species in ecosystems.	Summative assessment: B3.1 and B3.2 Plant studies
14	**April 27**	B4.2 Ecological niches	Difference between fundamental and realized niche. Impact of invasive species on ecosystems. Discussion on different methods to collect data on sessile and motile organisms. Skills: Students should use transect data to correlate the distribution of plant or animal species with an abiotic variable. Mathematical tools: Chi square test and t-test	Exam style practice questions
15	**May 4**	**Unit 2 review** **Formative assessment U2 (Mock 1)**		
16	**May 11**	Summative assessment: unit 2 (Mock 2)		
17	**May 18**	Exam style questions practice and review		
18	**May 25**	**Final Exam Week**		
19	**June 1**	**Enzyme activity labs**		
20	**June 8**	**Cellular respiration and photosynthesis labs**		
21	**June 15**	**Collaborative Science Project**		
Year 2 Semester 1				
1	**August**	B4.1	Investigation of structural, physiological, and behavioral adaptations that enable survival in diverse environments; including evolutionary context and ecological trade-offs.	Exam style questions
2	**August**	**B4.2**	In-depth study of energy flow and matter cycling through ecosystems, including food webs, ecological pyramids, production efficiencies, detrital pathways, and the roles of decomposers; quantitative aspects such as energy budgets and trophic efficiency.	Exam style questions
3	**September**	C4.1 populations and communities	Population dynamics, growth models, gene flow, genetic diversity, species interactions, community structure, and how environmental factors shape ecosystem composition and function. Skills: mathematical tools (chi square, t-test, percentage change)	Exam style questions **SUMMATIVE: Mock paper**
4	**September**	**C4.2 Transfer of energy and matter**	A deeper analysis of how energy moves through ecosystems, the fate of energy at each trophic level, and the limitations imposed by energy losses. Students examine energy pyramids, production efficiency, and the role of detritivores and decomposers in recycling matter, with quantitative aspects such as calculating efficiency and understanding how these concepts shape community structure and ecosystem resilience.	Exam style questions **FORMATIVE: C4.1 ; B4.1 ; B4.2**
5	**September**	Mathematical tools revision ; Mock 1		**Formative: Mathematical tools**
6	**September**	**IA work** **SUMMATIVE ASSESSMENT: Mock exam**		
7	**October**	**National Holiday**		
8	**October**	**Mock 2**		
9	**October**	B2.2	Function of membrane bound organelles. Advantages of compartmentalization	Exam style questions

Week	Week of…	Topic / Unit / Text	Content / Skill Development	Graded Assessments
10	**October**	**C1.2 Cellular respiration (SL & HL)**	In-depth exploration of cellular respiration steps (glycolysis, link reaction, Krebs cycle, electron transport chain, chemiosmosis), ATP yield under aerobic and anaerobic conditions, and regulation, with emphasis on energy transfer and redox chemistry.	Exam style questions
11	**October**	**D1.2 Protein synthesis HL content**	Students learn the central dogma steps—transcription of DNA into mRNA and translation of mRNA into polypeptides—along with the roles of ribosomes, tRNA, codons, and basic post-translational considerations.	Lab: investigating limiting factors on the rate of respiration
12	**November**	**D1.1 DNA replication**	Learn how DNA is duplicated prior to cell division, including the roles of enzymes (e.g., helicase, DNA polymerase), semi-conservative replication, and the purposes of replication accuracy and proofreading.	Exam style questions
13	**November**	**D1.3 Mutation and gene editing**	Students examine how changes in DNA sequences arise (spontaneous and induced mutations), the consequences for protein function, and modern gene-editing tools and their potential applications and ethics.	Exam style questions **Summative assessment: Unit 2**
14	**November**	D2.1 Cell and nuclear division	Students review mitosis and meiosis, their stages, outcomes (genetic diversity, chromosome number, and daughter cell identity), and the regulation of the cell cycle. Skills: Students should do this using diagrams as well as with cells viewed with a microscope or in a micrograph.	Exam style questions
15	**November**	**D2.2 Gene expression**	Students explore how gene expression is regulated in cells, including transcription factors, epigenetic influences, and selective expression in different cell types and developmental stages. **IA formal data collection**	Exam style questions
16	**December**	**D3.1 Reproduction**	Students compare sexual and asexual reproduction, reproductive strategies, gametogenesis, and the implications for genetic variation and population dynamics.	Exam style questions **Summative assessment: Unit 3 (all content)**
17	**December**	D3.1 Reproduction HL content	Students analyze pedigrees, generate and interpret Punnett grids for more complex crosses, and apply concepts to real-world human examples such as blood groups, color vision, and genetic diseases.	Exam style questions
18	**December**	**D3.2 Inheritance**	Students analyze how traits are transmitted across generations, including Mendelian genetics, dihybrid crosses, sex-linked patterns, and the impact of genetic variation.	Exam style questions
19	**December**	**Christmas & New Year**		
20	**January**	**Christmas & New Year**		
21	**January**	**D3.3 Homeostasis**	Students examine mechanisms that maintain stable internal conditions (positive/negative feedback, control systems, and example organ systems), emphasizing the importance of dynamic equilibrium.	Exam style questions
1	**January**	**D4.1 Natural selection** **D4.2 Stability and change**	Students study Darwinian and modern concepts of natural selection, adaptation, selective pressures, and how populations evolve over time. Students explore how ecosystems resist or respond to disturbances, the concept of resilience, and the balance between stability and transformation in living systems.	Hardy Weinberg calculation Exam style questions
2	**January**	**D4.3 Climate change**	Short description: Students assess evidence for climate change, its biological impacts on ecosystems and biodiversity, and the scientific, societal, and ethical considerations involved.	Exam style questions **Summative assessment: Unit 3 (all content)**
3	**January**	**Chinese New Year**		
4	**February**	**Chinese New Year**		
5	**February**	**DP Mock Examination Review**		
6	**February**	**DP Mock Examination**		
7	**February**	**C1.1 Enzymes**	Detailed enzyme kinetics, factors affecting activity (temperature, pH, inhibitors), regulation of metabolic pathways, and the role of enzymes in catalyzing key cellular reactions with quantitative analysis where appropriate.	Exam style questions
8	**March**	**C1.3 Photosynthesis**	Comprehensive study of light-dependent reactions and the Calvin cycle, the role of chloroplasts, ATP/NADPH production, and factors affecting photosynthetic rate, plus integration with cellular energy demands.	Exam style questions

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9	March	C2.1 Chemical signalling	Advanced signaling concepts including receptor-ligand interactions, second messengers, and signal transduction networks; cross-talk between pathways and how signaling influences cellular responses.	Exam style questions
10	March	C2.2 Neural signalling	Detailed structure and function of neurons, synaptic transmission, action potential generation, synaptic plasticity, and the integration of neural networks with physiological responses.	Exam style questions
11	March	C3.1 Integration of body systems	Systems-level integration showing how respiratory, circulatory, digestive, nervous, and endocrine systems coordinate to maintain homeostasis and support organismal function.	Exam style questions
12	March	C3.2 defence against disease	Innate and adaptive immune responses, recognition of pathogens, immune memory, vaccination concepts, and how pathogens evolve to evade defenses; includes epidemiological perspectives.	Exam style questions **Summative: Unit 4**
13	March	REVIEW (Mock exam)		
14	April	Easter Holiday		
15	April	REVIEW (Mock exam)		
16	April - May	IB DP May Examination		