**Curriculum**

**IB Biology Y2**

**Course Overview**

This course completes the Standard Level and Higher Level content of the IB, and uses the remaining time to work on a thorough review of all the material through presentations, lab work, and practice assessments. Students perform more involved experiments and projects, create presentations on IB content, and assess their own understanding of class materials in preparation for the IB exams.

**Department Standards**

**STANDARD 1: THE NATURE OF SCIENCE**

**STANDARD 2: SCIENCE AND TECHNOLOGY**

**STANDARD 3: THE PHYSICAL SETTING**

**STANDARD 4: THE LIVING ENVIRONMENT**

**STANDARD 5: SCIENCE AND SOCIETY**

**Benchmarks**:

[IB Benchmarks](http://acidale.on-rev.com/dante/Science/IBBiologyGuide.pdf)

**Performance Indicators**

**IB Biology Y2**

**Performance Indicators**

**First Quarter**

Differentiate between species, habitat, population, community, ecosystem and ecology. (IB 5.1.1)

Compare autotrophs and heterotrophs. (IB 5.1.2)

Differentiate the roles of producers, consumers, detritovores and saprotrophs in ecosystems. (IB 5.1.3)

Explain what is meant by a food web. (IB 5.1.5)

Generate food webs containing up to 10 organisms (aquatic and terrestrial). (IB 5.1.8)

Organize plants and invertebrates with taxonomic keys. Apply and design a key for a group of 8 organisms. (IB 5.5.1-5.5.5)

Analyze the energy flow in food webs. (IB 5.1.10-5.1.13)

Critique the difficulties of classifying organisms into trophic levels. (IB G.2.3)

Explain one method for measurement of biomass of different trophic levels in an ecosystem. (IB G.1.9, G.1.10)

Explain factors that affect plant and animal distributions.

Create an experiment using ecological sampling techniques: quadrats, transects,etc.(IB G.1.3, G.1.4)

Differentiate between fundamental and realized niches. (IB G.1.8)

Analyze an organism's habitat, feeding and interactions. (IB G.1.5, G.1.6)

Explain the principle of competitive exclusion. (IB G.1.7)

Apply the equation for net production to an energy pyramid: Gross production - respiration = net production. (IB G.2.1, G.2.2, G.2.5)

Produce a pyramid of energy including units kJ/m2yr1. (IB G.2.6)

Differentiate between primary and secondary succession, explaining the change in species diversity. (IB G.2.6, G.2.7)

Evaluate the life cycles of r-strategists and k-strategists. (IB G.5.1-G.5.2)

Analyze the distribution of six major biomes: desert, grassland, shrubland, temperate deciduous forest, tropical rainforest, tundra. (IB G.2.10-G.2.11)

Create a diagram of the carbon cycle including interactions of living organisms, including human activities impacting the cycle. (IB 5.2.1)

Analyze changes in concentration of atmospheric carbon dioxide using historical records and current data. (IB 5.2.2, 5.2.3)

Evaluate the precautionary principle as a justification for strong action in response to the threats posed by the enhanced greenhouse effect.(IB 5.2.4, 5.2.5)

Explain the consequences of a global temperature rise on arctic ecosytems.(IB 5.2.6)

Analyze the effects of UV radiation on living tissues and biological productivity. (IB G.3.9)

Explain the effects of CFCs on the ozone layer. (IB G.3.10)

Analyze the consequences of biomagnification, using a named example. (IB G.3.7-G.3.8)

Apply the Simpson Diversity Index to analyze the biodiversity of two communities. (IB G.3.1, G.4.1)

Evaluate the use of biotic indices and indicator species in monitoring environmental change. (IB G.4.1)

Explain reasons for the conservation of biodiversity, using rainforests as an example. (IB G.3.3)

Differentiate invasive species introductions as biological control, accidental, and deliberate. (IB G.3.4-G.3.6)

Explain the factors that contributed to the extinction of one named animal species. (IB G.4.2)

Create a plan for a nature reserve, beings sure to note the biogeographical features that promote diversity conservation. (IB G.4.1, G.4.3, G.4.4)

Evaluate the advantages of in situ conservation of endangered species for terrestrial and aquatic nature reserves. (IB G.4.5)

Evaluate ex-situ conservation measures including captive breeding, botanic gardens, and seed banks. (IB G.4.6)

Apply the Lincoln index to estimate population size of an animal species. (IB G.5.3)

Analyze the reasons for the exponential growth phase, the plateau phase and the transitional phase of the sigmoid growth curve. (IB 5.3.1-5.3.4)

Explain the methods used to estimate the size of commercial fish stocks. (IB G.5.4)

Evaluate international measures that would promote fish conservation and maximum sustainable yield. (IB G.5.5)

**Second Quarter**

Understand the divisions of the nervous system, types of neurons, and how they interact. (IB 6.5.1, 6.5.3)

Explain the structure of a motor neuron, including the direction an impulse travels. (IB 6.5.2)

Analyze how an action potential is generated along a non-myelinated neuron. (IB 6.5.4-6.5.5)

Analyze the principles of synaptic transmission and how drugs interfere. (IB 6.5.6)

Produce drawings and explanations of negative feedback loops as they relate to body temperature, carbon dioxide concentration, and blood glucose. (IB 6.5.7-6.5.11)

Differentiate between type I and type II diabetes. (IB 6.5.12)

Produce detailed and annotated drawings of the adult male and female reproductive systems and mature sperm and egg. (IB 6.6.1, 11.4.1, 11.4.4, 11.4.6, 11.4.7)

Analyze the roles of different hormones in development of sex characteristics. (IB 6.6.4)

Differentiate the roles of FSH, LH, estrogen and progesterone in the menstrual cycle.

(IB 6.6.2-6.6.3)

Analyze the processes of spermatogenesis and oogenesis. (IB 11.4.2, 11.4.3, 11.4.5, 11.4.8)

Explain the process of fertilization, including the acrosome and cortical reactions. (IB 11.4.9)

Evaluate the ethical issues associated with in vitro fertilization. (IB 6.6.5-6.6.6)

Create a flow chart detailing the process of embryonic development including hormones, implantation of the blastocyst, the placenta, and finally the process of birth. (IB 11.4.10-11.4.15)

Explain the structure of a human elbow joint, including bones, ligaments, tendons, muscles, nerves, joint capsule, and synovial fluid. (IB 11.2.1-11.2.3)

Analyze the movements of different types of joints. (IB 11.2.4)

Produce a drawing of striated muscle fibers showing the relationship of actin and myosin filaments. (IB 11.2.5, 11.2.6)

Analyze the contraction of skeletal muscle. (IB 11.2.7-11.2.8)

Produce an annotated diagram of the nephron, detailing the locations of utrafiltration, selective reabsorption, water conservation, ph and an ion concentration regulation, and water reabsorption at collection ducts. (IB 11.3.1-11.3.3,11.3.5-11.3.7)

Analyze the process of ultrafiltration in relationship to capillaries and the nephron. (IB 11.3.4)

Differentiate composition of blood plasma, glomerular filtrate, and urine. (IB 11.3.8)

Apply knowledge of diabetes to the presence of glucose in urine. (IB 11.3.9)

**Third Quarter**

Explain processes needed for spontaneous origin of life on Earth. (IB D.1.1-D.1.4)

Analyze how protobionts may have proceeded living cells. (IB D.1.6)

Apply knowledge of RNA, DNA, and transcription to outline properties that would allow RNA to play a role in the origin of life. (IB D.1.5)

Explain how prokaryotic organisms contributed to the creation of an oxygen-rich atmosphere. (IB D.1.7)

Evaluate the endosymbiotic theory. (IB D.1.8)

Evaluate evidence for evolution provided by fossil record, radioisotopes, and comparative anatomy and embryology. (IB 5.4.1, 5.4.2, D.3.1-D.3.3)

Differentiate between the mechanisms involved in natural selection. (IB 5.4.3-5.4.7)

Critique the definitions of species. (IB D.2.3)

Analyze different barriers between gene pools leading to evolution. (IB D.2.4-D.2.8)

Apply knowledge of DNA and base substitution to evolution and polymorphism. (IB D.2.10-D.2.11)

Analyze primate features of humans, including the development of bipedalism. (IB D.3.4)

Generate a time line of hominid fossils that depicts trends, distribution, and key features of species. (IB D.3.5-D.3.7)

Analyze various brain sizes and dentition of hominids to discuss the correlation between change in diet and increase in brain size. (IB D.3.8)

Evaluate the importance of genetic and cultural evolution in the recent evolution of humans. (IB D.3.9-D.3.10)

Evaluate Hardy-Weinberg equilibrium assumptions. (IB D.4.1, D.4.3)

Implement the Hardy-Weinberg equation to determine allele, genotype, and pheonotype frequencies in populations. (IB D.4.2)

Analyze 'tree-diagrams' to determine relationships and common ancestry. (IB D.5.1, D.5.5)

Create cladograms and discuss their relationship to classification of living organisms. (IB D.5.8-D.5.10)

Apply the biochemical evidence of DNA and protein structures for the common ancestry of living organisms. (IB D.5.2, D.5.4)

**Fourth Quarter**

Analyze the physical characteristics of various angiosperms to distinguish between monocot and dicot features. (IB 9.1.2)

Differentiate between the tissues and their functions in a dicot plant. (IB 9.1.1, 9.1.3, 9.1.5, 9.1.6)

Explain the modifications of roots, stems, and leaves for different functions. (IB 9.1.4)

Analyze the role of auxin in phototropism. (IB 9.1.7)

Analyze the relationship between the action spectrum and the absorption spectrum of photosynthetic pigments. (IB 3.8.1-3.8.4, 8.2.7)

Produce an annotated diagram of a chloroplast, as it would appear in an electron micrograph. (IB 8.2.1, 8.2.6)

Analyze the light-dependent reactions, including photolysis, photosystems, electron transport chain, chemiosmosis and photophosphorylation. (IB 3.8.5, 8.2.3-8.2.4)

Analyze the light-independent reactions. (IB 3.8.6, 8.2.5)

Create an experiment that investigates factors influencing the rate of photosynthesis. (IB 3.8.7-3.8.8, 8.2.8)

Analyze the movement of minerals and water into a plant and their continued transport up a plant. (IB 9.2.1-9.2.3)

Explain plant cell structures that give a plant support. (IB 9.2.4, 9.2.6)

Create an experiment to investigate factors affecting the rate of transpiration in a typical terrestrial plant. (IB 9.2.5, 9.2.6, 9.2.9-9.2.10)

Explain guard cell regulation of transpiration and the role of abscisic acid. (9.2.7, 9.2.8)

Attribute adaptations of xerophytes to reduce transpiration. (9.2.10)

Analyze the role of phloem in active translocation of sugars and amino acids. (9.2.11

Produce and annotate a diagram of a dicotyledonous animal-pollinated flower and a named dicotyledonous seed. (IB 9.3.1, 9.3.3)

Differentiate the role conditions, hormones and enzymes in the germination of a typical seed. (IB 9.3.4-9.3.5)

Analyze the differences between pollination, fertilization, and seed dispersal. (IB 9.3.2)

Analyze how flowering is controlled in long-day and short-day plants, including the role of phytochrome. (IB 9.3.6)

**Assessments**

**IB Biology Y2**

**Assessments**

**First Quarter**

Homework

Quizzes

Tests

Laboratory Reports for IB Internal Assessments

**Second Quarter**

Homework

Quizzes

Tests

Laboratory Reports for IB Internal Assessments

Semester Exam

**Third Quarter**

Homework

Quizzes

Tests

Laboratory Reports for IB Internal Assessments

**Fourth Quarter**

Homework

Quizzes

Tests

Laboratory Work with Fast Plants

Mock IB Examinations

**Core Topics**

**IB Biology Y2**

**Core Topics**

**First Quarter**

Community Ecology

Classification

Ecosystems and Biomes

Impacts of Humans on Ecosystems

Conservation of Biodiversity

Population Ecology

**Second Quarter**

Nerves, Hormones, and Homeostasis

Reproduction

Muscles and Movement

The Kidney

**Third Quarter**

Origin of Life on Earth

Species and Speciation

Human Evolution

The Hardy-Weinberg Principle

Phylogeny and Systematics

Plant Structure and Growth

**Fourth Quarter**

Photosynthesis

Transport in Angiospermophytes

Reproduction in Angiospermophytes

Review for the IB Biology Exam

**Specific Content**

**IB Biology Y2**

**Specific Content**

**First Quarter**

Levels of organization in biosphere

Autotrophs and energy

Heterotrophs and energy

Trophic levels and energy transformations

Detritovores and saprotrophs

Food chains and food webs

Distribution of plant and animal species

Sampling techniques to estimate population sizes

Symbiotic relationships

Niche concepts

Competitive exclusion principle

Gross and net production in ecosystems

Succession

r-strategies and K-strategies

Characteristics and distribution of major biomes

Greenhouse effect

Carbon cycle

Precautionary principle

Climate change impacts

CFCs and ozone Layer

Biomagnification

Biodiversity - Simpson Index

Invasive species

Endangered and extinct species

*In situ* and *Ex situ* conservation

Populations-sigmoid growth curves

Lincoln Index

Conservation of fish Ssocks

**Second Quarter**

Divisions of the nervous system

Structure and function of motor neuron

Synaptic transmission

Endocrine system

Negative feedback

Maintaining body temperature

Maintaining glucose levels

Type I and II diabetes

Male and female reproductive systems

Hormones of the menstrual cycle

Oogenesis and spermatogenesis

Fertilization

*In vitro* fertilization

Placenta

Birth process

Human elbow joint

Movement of joints

Structure of skeletal muscles

Function of Skeletal Muscles

Excretion

Structure and function of nephron

Osmoregulation

**Third Quarter**

Non-living synthesis of simple organic molecules

Protobionts

RNA world

Development of oxygen-rich atmosphere

Endosymbiotic Theory

Evidence for evolution

Dating fossils with radioisotopes

Mechanism of natural selection

Species definition

Gradualism and punctuated equilibrium

Allopatric and sympatric speciation

Adaptive radiation

Polyploidy

Polymorphism

Features of primates

Fossil trends in hominids

Nutrition and brain size

Genetic and cultural evolution

Assumptions made for Hardy-Weinberg

Calculations using Hardy-Weinberg

Cladistics

Homologous and analogous characteristics

Biochemical evidence and common ancestry

**Fourth Quarter**

Monocotyledonous and dicotyledonous characteristics

Tissues in stem and leaf of dicot

Functions of tissues

Apical and lateral meristems

Auxin and phototropism

Action spectrum and absorption spectrum

Chloroplast structure and function

Light dependent reactions

Light independent reactions

Rate of photosynthesis

Uptake of minerals and water at roots

Support in terrestrial plants

Transpiration

Guard cells and stomata

Abiotic factors affecting rate of transpiration

Adaptations of xerophytes

Translocation of materials via phloem

Dicot flowers

Pollination, fertilization, and seed dispersal

Germination of a seed

Flowering and phytochrome

**Resources**

**IB Biology Y2**

**Resources**

*Advanced Biology: Principles and Applications*  by Clegg and Mackean. Publication date: 2000. Hodder Education.

*Biology for the IB Diploma* by Clegg. Publication date: 2007. Hodder Education.

*OSC IB Biology Revision Guides: Guide for Internal Assessment; Higher Level IB Biology* by Merson-Davies. Publication Date: 2008. OSC Publishing.

*IB Study Guides: Biology for the IB Diploma, Standard and Higher Level*  by Allott. Publication Date: 2007. Oxford University Press.

Kew Gardens - Sampling Course; Thorpe Hay Meadow (at Thorpe Lea); School Grounds

Kew Gardens - Biodiversity Course

Online real-time data on greenhouse gases from NOAA, Mauna Loa, etc.

Simulation activities - Floristic Succession game; capture-recapture

Inconvenient Truth; IPCC; CReSIS; NOAA; NASA images; National Park Service;

Surrey Wildlife TrustHuman Anatomy Models