# WOLMER'S BOYS' SCHOOL

## *Department of Science*

## *Form 6B*

## *Biology Course Outline*

## RATIONALE

CAPE Biology includes independent study, laboratory investigations (School Based Assessments [SBAs]), and lecture, with evaluation by objective and essay examination. The course consists of two Units; Unit 1 covered in lower six and Unit 2 in upper six. Unit 1 consists of three (3) Modules:

Module 1: Cell & Molecular Biology

Module 2: Genetics, Variation & Natural Selection

Module 3: Reproductive Biology

Students will focus on Module 2 during the Christmas Term, Modules 1 and 3 for the duration of Summer and Easter Terms in the Lower Sixth Year. A quiz will be given at the end of each completed topic to recap the concept(s) and assess students' comprehension. Please note that the results obtained from the quizzes may contribute to classwork grades. Tutorial sessions will also be used during this course, to demonstrate how to accurately answer past paper questions, in particular, data analysis.

Similar to CSEC Biology, SBAs are done as Paper III and contribute to 20% of the overall external examination grade. SBAs will be done as laboratory experiments. Books are not required; students have the option to type or neatly hand write each laboratory report and submit each on or before the deadlines given by the instructor. **Please note <u>ALL SBA</u> reports are due <u>EXACTLY ONE WEEK</u> after they have been given.**

CAPE Biology requires much work to be done over an eight month period, which means it requires a significant amount of effort; students will need to complete additional reading and complete several activities (graded and ungraded) to assist with exam preparation.

I may be contacted by my email address if there are any concerns regarding the course and course contents. Email address: Kaz-hoshay.blackwood-harrison@wolmers.org

# Wolmer's Boys' School

## 6B BIOLOGY COURSE OUTLINE [ADAPTED FROM THE CAPE BIOLOGY SYLLABUS (2008 – 2019)]

## TERM ONE: SEPT - DEC 2023

| Week | CAPE Objective | Mode of delivery | Use of ICT | Practical/ Assessment |
|---|---|---|---|---|
| **NUCLEIC ACIDS** | | | | |
| (Sept 11 - 15) | Compare the structure of RNA and DNA using simple labelled diagrams | Display images that demonstrate shapes; structural formulae of nucleotides, ribose & deoxyribose, pyrimidines, purines; nature of hydrogen bonds. | Use of pictures from online, include in a PowerPoint and allow students to make models from viewing powerpoint. | Use construction (or any other coloured) paper or play dough to make models/shapes of the purines and pyrimidines. |
| Sept 18 - 22 | Explain the importance of hydrogen bonds and base pairing in DNA replication. | Illustrate and explain significance of 5' and 3'; semiconservative replication; genetic code; initiation, transcription, translation, termination. | View Video/Animation on DNA Replication Include questions for students to answer based on the video/animation | Use models to demonstrate DNA and RNA base pairing.<br><br>Use models to show base-pair bonding, 5' - 3'<br><br>4 rounds of DNA replication using play dough, yarn, etc.(CW) |

| Week | CAPE Objective | Mode Of Delivery | Use of ICT | Suggested Practical/Assignment |
|---|---|---|---|---|
| Sept 25 - 29 | Explain the relationship between the structure of DNA, protein structure and the phenotype of an organism; | Deduce, via discussion, that phenotype is determined by proteins, which are determined by DNA sequences | | Use online game as a revision tool (CW)<br><br>***DNA & RNA QUIZ (CW 1)***<br><br>***(Sept 26)*** |
| | Explain the relationship between the sequence of nucleotides and the amino acid sequence in a polypeptide; | Display Codon chart to show that amino acids are made based on which N-bases come together. | Share a YouTube playlist that will provide information on this | Deduce the amino acids based on the codon list given. students will compete, in pairs, to complete activity. (CW) |
| | Describe the roles of DNA and RNA in protein synthesis; | Specify types of RNA (tRNA, mRNA, rRNA) and their functions. | Students will use a podcast app | create a 2 minute podcast which describes the role of DNA and RNA in protein synthesis (HW 1) |
| Oct 2 - 6 | Describe the relationship among DNA, chromatin, and chromosomes | | Google Slides<br>Projector<br>Laptop<br>Speakers | View microscope slides and make comparisons between all three.<br><br>observe images and differentiate between all three structures |

| Week | CAPE Objective | Mode of Delivery | Use of ICT | Suggested Practical/Assignment |
|---|---|---|---|---|
| **CELL DIVISION & VARIATION** | | | | |
| **Oct 2 - 6** | Parts of a light and electron microscope | students will get labels to guess the part of the microscope and attach labels. Afterwards, they will get a video to watch to compare their labels with the correct labels. | Light Microscope laptop projector internet | label the parts of a microscope |
| | Compare the light and electron microscopes | | | view and label images from light microscope and electron micrographs |
| | Describe with the aid of diagrams, the processes involved in mitotic cell division; | Go through each phase, do drawings to illustrate differences between each phase Include interphase as part of the cell cycle, but not part of mitosis. | Students will go online to look up images of the phases of Mitosis. Print & annotate Images | SBA #1 ***Lab 1: Calibration of Light Microscope.*** ***SKILL: M&M*** ***HW 1*** |
| | Explain the importance of DNA replication for maintaining genetic stability; | | | |
| | Discuss the role and importance of mitosis in growth, repair and asexual reproduction; | Use of reals life situations in which mitosis is demonstrated. | Research body processes that make use of Mitosis | |

| Week | CAPE Objective | Mode of delivery | Use of ICT | Suggested Practical/Assignment |
|---|---|---|---|---|
| ***Lab practicals begin this week*** | Describe with the aid of diagrams, the processes involved in Meiotic cell division; | Display structures or give examples of people/things with similar physical features and relate too homologous chromosomes | | |
| | Discuss how Meiosis contributes to heritable variation | | | **H.W.**: to be based on topics from weeks 4 & 5. |

| Date | CAPE Objective | Mode of delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **CELL DIVISION & VARIATION** | | | | |
| Week 7 | Explain why sexually produced organisms vary in characteristics.<br><br>Describe gene and chromosome mutations;<br><br>Discuss the implications of changes in DNA nucleotide sequence for cell structure and function in sickle cell anaemia. | | Online practice activities will be given to be done in own time | **C.W.: Based on Patterns of Inheritance** |

| Date | CAPE Objective | Mode of delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **CELL DIVISION & VARIATION** | | | | |
| Week 8 | explain how mutation brings about | Use of story/drama to | Use of google slides to present | Question and answer to recap lesson |

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| | genetic variation;<br><br>explain why heritable variation is important to selection; | introduce topic and then display images, show videos, guide class discussion on how differences in genetic make up lead to variation and selection, and also how the environment influences variation | images and videos.<br>Students to search for YouTube videos related to topic and share with class via Google Groups/Google+ | |

| Week | CAPE Objective | Mode of delivery | Use of ICT | Suggested Practical/Assignment |
|---|---|---|---|---|
| **PATTERNS OF INHERITANCE** | | | | |
| (WEEK 9) | Explain the terms: gene, allele, dominant, recessive, codominant, homozygous and heterozygous.<br><br>Use genetic diagrams to solve problems involving monohybrid and dihybrid crosses; | Use of organisms or images of organisms to show what each term means.<br><br>Include those involving sex linkages, codominance multiple alleles and dominant epistasis. Candidates should understand the ratios | PowerPoint presentation | ***Lab 2: Make drawings from prepared slides, and/or a freshly prepared root tip squash to show the stages of mitosis; prophase, metaphase anaphase, telophase.***<br><br>***SKILL: DRAWING*** |

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| Date | CAPE Objective | Mode of Delivery | Use of ICT | Suggested practical/Assignment |
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| **PATTERN OF INHERITANCE** | | | | |
| (WEEK 10) | Use genetic diagrams to solve problems involving monohybrid and dihybrid crosses (continuation) | Use past paper questions to work genetic diagram problems | Quizizz online quiz platform | ***Give Lab 3 as project to be submitted in Week 8 .*** ***Lab 3: Construct models to demonstrate chromosome behaviour in meiosis ******* ***SKILL: MM*** |

| Date | CAPE Objective | Mode of delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **PATTERN OF INHERITANCE** | | | | |

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| Week 11 | Analyse the results of a genetic cross by applying the Chi-square test.<br><br>Determine whether the difference between the observed and expected ratio is significant using the results of the Chi-square test | Use of Chi-squared table. Formulae will be given. Set out data in tabular form.<br><br>Include the concept of probability. Explain the use of 0.05 confidence limits and the null hypothesis. | Online practice activities will be given to be done in own time | **C.W.: Based on Meiosis & Mitosis**<br><br>**Lab 4 Proposal** |

| Date | CAPE Objective | Mode of delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **NATURAL SELECTION** | | | | |
| Week 12 | explain how environmental factors act as forces of natural selection;<br><br>explain how natural selection may be an agent of constancy or an agent of change<br><br>discuss natural selection as a mechanism of evolution;<br><br>discuss the biological species concept; | Build on knowledge base using question and answer technique | Use of google Groups &/or Google+ to post questions & links to websites that students can use to create their own notes. | Self-paced testing using Quizlet.com |

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| | Explain the process of speciation. | | | |

Week 13

REVISION & CLARIFICATION

END OF TERM EXAMINATIONS

*** Pipe cleaners, plastic wire, embroidery thread, cartridge paper, etc may be used for modelling chromosome behaviour in meiosis – **biodegradable materials unacceptable**

LAB PRACTICALS:

- Will begin in week three
- Will be:
    - Calibration of light microscope
    - Stages of Mitosis
    - Chromosome behaviour during meiosis

PROJECT:

- Lab 3 – to be done as group work

CLASSWORK:

- Will be given in weeks 2, 7 & 8

HOMEWORK:

- Will be given in weeks 3, 4, 6

## Wolmer's Boys' School

### 6B BIOLOGY COURSE OUTLINE

### [ADAPTED FROM THE CAPE BIOLOGY SYLLABUS (2008 – 2019)]

### TERM TWO: JAN – APRIL 2021

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/ Assessment |
|---|---|---|---|---|
| **ASPECTS OF GENETIC ENGINEERING** | | | | |
| Week 1 | **Review of Exam papers for corrections, etc**<br><br>Outline the principles of restriction enzyme use in | Crossword puzzle with key terms.<br><br>Terms will be discussed after they are found. | Video Conference* or Video demonstration of procedure. | ***C.W. based on Natural Selection*** |

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| | removing sections of the genome<br><br>Explain the steps involved in recombinant DNA technology<br><br>Discuss the possible benefits and hazards of gene therapy<br><br>Discuss the implications of the use of genetically modified organisms on humans and the environment. | Students research and present their findings on gene therapy and GMO | | ***Lab 5. Natural Selection***<br>***Skill: AI*** |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/ Assessment |
|---|---|---|---|---|
| **BIOCHEMISTRY** | | | | |
| Week 2 | Discuss how the structure and properties of water relate to the role that water plays as a medium of life; | Display images or structure of water<br>Engage students in a discussion on what water is and its importance in daily life of all organisms | Use of PowerPoint presentation to display animations, images and videos of | Edpuzzle interactive video lessons. |

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| | | | properties of water | ***H.W. based on genetic engineering*** |
| Week 3 | | **STRUCTURE**<br>Use of Jamboard to draw the structure of the ring and straight chained form of glucose, and differentiate between alpha and beta glucose<br>Coin jingles or phrases to help students remember differences between types of<br>**FUNCTION**<br>Recall fifth form knowledge of carbohydrates and build on it through discussion and notes | Jam Board, Google slides | 1. Do drawings of their own, take a picture and upload to google classroom.<br>**2. Lab 6 Food Tests**<br>**Skill: M&M, ORR** |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **BIOCHEMISTRY** | | | | |

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| Week 3 Cont'd | Explain the relationship between the structure and function of sucrose; | **STRUCTURE**<br>Use of Jamboard to draw the structure of the ring and straight chained forms of fructose and galactose.<br>Name and differentiate between the different disaccharides<br><br>**FUNCTION**<br>Recall fifth form knowledge of carbohydrates and build on it through discussion and notes | Jam Board, Google tool, to illustrate structures | Students are given images or 3D representation of different disaccharides and their constituent monosaccharides which they are to identify. |
| Week 4 | Discuss how the molecular structure of starch, glycogen and cellulose relate to their functions in living organisms;<br><br>Describe the molecular structure of a triglyceride and its role as a source of energy; | Test prior knowledge using a game called "What am I?"<br><br>Name a few things that contain all three polysaccharides and use the information known about those substances to deduce functions and relate to the molecular structure.<br><br>Draw the structure of a triglyceride and use structure to relate to function | Use of google slides to illustrate structures | **Lab 7 Semi-Quantitative Analysis.**<br><br>**Skill: M&M, AI**<br><br>**Lab 8 P&D- Lipids, Due week 6** |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|

| ASPECTS OF BIOCHEMISTRY | | | | |
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| Week 5 | describe the Structure of phospholipids and their role in membrane structure and function;<br><br>describe the generalised structure of an amino acid, and the formation and breakage of a peptide bond;<br><br>explain the meaning of the terms: primary, secondary, tertiary and quaternary structures of proteins;<br><br>outline the molecular structure of haemoglobin, as an example of a globular protein, and of collagen, as an example of a fibrous protein; | Recall structure of triglycerides and use drawings to show similarities between phospholipids and triglycerides | Ask students to go online, look up images of phospholipids, triglycerides and carbohydrates, and practice drawing structures. | C.W. Based on Biochemistry |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **CELL STRUCTURE** | | | | |
| Week 6 | Microscopy<br>Differences between electron and light microscope and between resolution and magnification. | Live demonstration of parts of light microscope and their functions.<br><br>Discussion on Electron Microcope. | Students to use internet to acquire images of electron micrographs and present to share on Google+ and | **H.W.** Compare light and electron microscope, in google sheet and upload to google classroom. Describe and interpret drawings and electron |

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| | Outline the functions of membrane systems and organelles; | What it is and how it works<br><br>Use of models to show parts of the cell | in physical classroom. | micrographs of the structure of membrane systems and organelles of typical animal and plant cells |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **CELL STRUCTURE** | | | | |
| Week 6 cont'd | Compare the structure of typical animal and plant cells;<br><br>Describe the structure of a prokaryotic cell;<br><br>Compare the structure of prokaryotic cells with that of eukaryotic cells;<br><br>Explain the concepts of tissue and organ using as an example the dicotyledonous root; | Students are given resource materials to read and answer questions based on resources given.<br><br>Use of Drawings/charts/etc to illustrate cells. | Internet Google Classroom for submission of information<br><br>Google+ to post information found so they can collaborate | **Lab 9 Plant and Animal cells**<br><br>***Skill: Drawing***<br><br>Use of cell descriptions and structures to make comparisons between prokaryotes and eukaryotes |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **MEMBRANE STRUCTURE & FUNCTION** | | | | |
| Week 7 | explain the fluid mosaic model of membrane structure;<br><br>explain the processes of diffusion, facilitated diffusion, osmosis, active transport, endocytosis and exocytosis;<br><br>investigate the effects on plant cells of immersion into solutions of different water potentials. | | | **Lab 10 Plan Drawing of Dicot Root**<br><br>***Skill: Drawing*** |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **ENZYMES** | | | | |
| Week 8 | explain that enzymes are globular proteins that catalyse metabolic reactions; | | | |

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| | explain the mode of action of enzymes in terms of an active site, enzyme and/or substrate complex, lowering of activation energy and enzyme specificity; | | | |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **ENZYMES** | | | | |
| Week 8 cont'd | explain the effects of pH, temperature, enzyme concentration and substrate concentration on enzyme action;<br><br>explain the effects of competitive and non-competitive inhibitors on enzyme activity; | | | ***Lab 11 effect of temperature and substrate concentration on enzyme activity***<br><br>***Skill: ORR, A&I*** |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **SEXUAL REPRODUCTION IN HUMANS** | | | | |
| Week 9 | describe the structure and function of the male and female reproductive systems; | | | ***Lab 12 drawing of mammalian Ovary and testes***<br><br>***Skill: Drawing*** |

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| | compare the structure of the ovum and the sperm;<br><br>discuss how the structure of the ovum and the sperm suit their functions; | | | |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **SEXUAL REPRODUCTION IN HUMANS** | | | | |
| Week 10 | explain gametogenesis;<br><br>explain how hormones regulate gametogenesis;<br><br>discuss the importance of hormones in the control of the menstrual cycle;<br><br>describe how and where fertilization and implantation normally occur; | | | ***H.W based on membrane structure and function and cell structure*** |

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| | discuss how knowledge of human reproductive anatomy and physiology has been applied to the development of contraceptive methods; | | | |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
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| **SEXUAL REPRODUCTION IN HUMANS** | | | | |
| Week 11 | Explain the structure and functions of the placenta;<br><br>Discuss the functions of the amnion;<br><br>**Discuss the possible effects of maternal behaviour on foetal development. | | | ***C.W. based on reproduction in Humans and Enzymes*** |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|

| SEXUAL REPRODUCTION IN FLOWERING PLANTS | | | | |
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| Week 11 CONT' D | describe the structure of the anther and the formation of pollen grains;<br><br>describe the structure of the ovule and the formation of the embryo sac;<br><br>explain how cross-fertilisation is promoted; | | | ***Lab 13***<br>***Lilium anther and embryo sac***<br>***Skill: Drawing*** |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **SEXUAL REPRODUCTION IN FLOWERING PLANTS** | | | | |
| Week 12 | **discuss the genetic consequences of sexual reproduction in terms of self and cross fertilization<br><br>explain the sequence of events from pollination to fertilization | | | |

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| | explain the significance of double fertilization in the embryo sac;<br><br>discuss the development of the seed and the fruit from the embryo sac and its contents, the ovule and the ovary. | | | |

| Date | CAPE Objective | Mode of Delivery | Use of ICT | Practical/Assessment |
|---|---|---|---|---|
| **ASEXUAL REPRODUCTION** | | | | |
| Week 13 | explain the term asexual reproduction; | | | |

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| | **discuss the advantages and disadvantages of asexual reproduction;<br><br>explain the principles and the importance of vegetative propagation as exemplified by the use of cuttings and tissue culture;<br><br>**discuss the genetic consequences of asexual reproduction. | | | |

LAB PRACTICALS:

- Will begin in week one
- Will be:

- Natural Selection
- Food Test
- Semi-Quantitative Analysis
- Plant  Animal Cells
- Plan Drawing of Dicot Root
- Effect of Temp on enzyme activity
- Drawing of mammalian ovary and sperm
- Drawing of *Lilium* Anther and Embryo sac
- Implementation
- P&D -Lipid

PROJECT:

- TBD

CLASSWORK:

- Will be given in weeks 1, 5 and 11

HOMEWORK:

- Will be given in weeks 2, 6 and 10