



Programme of Study – Grade 13 (Year 14) Biology

	Theme	Overview of key learning to take place	How learning will be assessed
Term 2	Topic 17- Selection and evolution	<p>17.1 and 17.2: Variation and Natural and artificial selection</p> <ul style="list-style-type: none">• I can describe the differences between continuous and Discontinuous variation and explain the genetic basis of Continuous and discontinuous variation.• I can explain, with examples, how the environment may affect the phenotype of plants and animals.• I can use the t-test to compare the variation of two different Populations.• I can explain why genetic variation is important in selection.• I can explain that natural selection occurs as populations have the capacity to produce many offspring that compete for resources; in the 'struggle for existence' individuals that are best adapted are most likely to survive to breed and pass on their alleles to the next generation.• I can explain, with examples, how environmental factors can act as stabilising, disruptive and directional forces of natural selection.• I can use the Hardy–Weinberg principle to calculate allele, genotype and phenotype frequencies in populations and explain situations when this principle does not apply.• I can outline the following examples of crop improvement by selective breeding:• I can discuss the introduction of disease resistance to varieties of wheat and rice• I can explain the incorporation of mutant alleles for gibberellin synthesis into dwarf varieties so increasing yield by having a greater proportion of energy put into grain• I can state how inbreeding and hybridisation will produce vigorous, uniform varieties of maize.	<p>Examples of Formative Assessment to be used this term:</p> <p>(i) Homework 2 x 60 minute tasks</p> <ol style="list-style-type: none">1. Board exam questions set as homework2. Homework assignments with recall tasks <p>Summative assessment:</p> <p>(ii) Topic 17 end of unit exam paper (long answer questions)</p> <p>(iii) Quiz 40 minutes task (Board Exam questions)</p>

Term 2		<p>17.3: Evolution</p> <ul style="list-style-type: none"> • I can state the general theory of evolution that organisms have changed over time • I can discuss the molecular evidence that reveals similarities between closely related organisms with reference to mitochondrial DNA and protein sequence data • I can explain how speciation may occur as a result of geographical separation (allopatric speciation), and ecological and behavioural separation (sympatric speciation) • I can explain the role of pre-zygotic and post-zygotic isolating mechanisms in the evolution of new species • I can explain why organisms become extinct, with reference to climate change, competition, habitat loss and killing by humans 	
Term 2	Topic18- Biodiversity, classification and conservation	<p>18.1: Biodiversity</p> <ul style="list-style-type: none"> • I can define the terms species, ecosystem and niche • I can explain that biodiversity is considered at three different levels: <ul style="list-style-type: none"> • variation in ecosystems or habitats • the number of species and their relative abundance • genetic variation within each species • I can explain the importance of random sampling in determining the biodiversity of an area • I can use suitable methods, such as frame quadrats, line transects, belt transects and mark-release-recapture, to assess the distribution and abundance of organisms in a local area • I can use Spearman's rank correlation and Pearson's linear correlation to analyse the relationships between the distribution and abundance of species and abiotic or biotic factors • I can use Simpson's Index of Diversity (D) to calculate the biodiversity of a habitat, using the formula $D = 1 - \left(\sum \left(\frac{n}{N}\right)^2\right)$ and state the significance of different values of D 	<p>Examples of Formative Assessment to be used this term:</p> <p>(i) Homework 2 x 60 minute tasks</p> <ol style="list-style-type: none"> 1. Exam questions set as homework 2. Homework assignments with recall tasks

18.2 :Classification

- I can describe the classification of species into the taxonomic hierarchy of domain, kingdom, phylum, class, order, family, genus and species.
- I can outline the characteristic features of the three domains Archaea, Bacteria and Eukarya
- I can outline the characteristic features of the kingdoms Protocista, Fungi, Plantae and Animalia
- I can explain why viruses are not included in the three domain classification and outline how they are classified, limited totypes of nucleic acid (RNA or DNA) and whether these are single stranded or double stranded.

18.3: Conservation

- I can discuss the threats to the biodiversity of aquatic and terrestrial ecosystems
- I can discuss the reasons for the need to maintain biodiversity
- I can discuss methods of protecting endangered species, including the roles of zoos, botanic gardens, conserved areas (national parks and marine parks), 'frozen zoos' and seed banks
- I can discuss methods of assisted reproduction, including IVF, embryo transfer and surrogacy, used in the conservation of endangered mammals
- I can discuss the use of culling and contraceptive methods to prevent overpopulation of protected and non-protected species
- I can use examples to explain the reasons for controlling alien species
- I can discuss the roles of non-governmental organisations, such as the World Wide Fund for Nature (WWF) and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), in local and global conservation
- I can outline how degraded habitats may be restored with reference to local or regional examples

Summative assessment:

(ii) Quiz 40 minutes task
(Board Exam questions)

(iii) Topic 18 end of unit exam paper (long answer questions)

19 Genetic technology

19.1 Principles of genetic technology

- I can define the term recombinant DNA
- I can explain that genetic engineering involves the extraction of genes from one organism, or the synthesis of genes, in order to place them in another organism (of the same or another species) such that the receiving organism expresses the gene product
- I can describe the principles of the polymerase chain reaction (PCR) to clone and amplify DNA
- I can describe and explain how gel electrophoresis is used to analyse proteins and nucleic acids, and to distinguish between the alleles of a gene
- I can describe the properties of plasmids that allow them to be used in gene cloning
- I can explain why promoters and other control sequences may have to be transferred as well as the desired gene
- I can explain the use of genes for fluorescent or easily stained substances as markers in gene technology
- I can explain the roles of restriction endonucleases, reverse transcriptase and ligases in genetic engineering
- I can explain, in outline, how microarrays are used in the analysis of genomes and in detecting mRNA in studies of gene expression

19.2: Genetic technology applied to medicine

- I can define the term bioinformatics
- I can outline the role of bioinformatics following the sequencing of genomes, such as those of humans and parasites, e.g. Plasmodium.
- I can explain the advantages of producing human proteins by recombinant DNA techniques (reference should be made to some suitable examples, such as insulin, factor VIII for the treatment of haemophilia and adenosine deaminase for treating severe combined immunodeficiency (SCID))
- I can outline the advantages of screening for genetic conditions

Examples of Formative Assessment to be used this term:

(i) Homework 2 x 60 minute tasks

1. Exam questions set as homework

2. Homework assignments with recall tasks

Summative assessment:

(ii) Quiz 30 minutes task
(Board Exam questions)

(iii) Topic 19 end of unit exam paper (long answer questions)

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| | | <ul style="list-style-type: none">• I can outline how genetic diseases can be treated with gene therapy and discuss the challenges in choosing appropriate vectors, such as viruses, liposomes and naked DNA• I can discuss the social and ethical considerations of using gene testing and gene therapy in medicine• I can outline the use of PCR and DNA testing in forensic medicine and criminal investigations. | |
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19.3 Genetically modified organisms in agriculture

- I can explain the significance of genetic engineering in improving the quality and yield of crop plants and livestock in solving the demand for food in the world, e.g. Bt maize, vitamin A enhanced rice (Golden rice™) and GM salmon
- I can outline the way in which the production of crops such as maize, cotton, tobacco and oil seed rape may be increased by using varieties that are genetically modified for herbicide resistance and insect resistance
- I can discuss the ethical and social implications of using genetically modified organisms (GMOs) in food production