COURSE OUTLINE
BIOLOGY – ATAR YEAR 12: 2021
UNIT 3 AND UNIT 4

Unit 3: Semester 1 Continuity of species Student Course Outline

Term	Week	Topic	Key teaching points / Syllabus Content	Assessment
1	1	**Science Inquiry Skills**	**Science Inquiry Skills SIS 1-7** • Identify, research and construct questions for investigation; propose hypotheses; and predict possible outcomes • Design investigations, including the procedure(s) to be followed, the materials required, and the type and amount of primary and/or secondary data to be collected; conduct risk assessments; and consider research ethics, including animal ethics • Conduct investigations, including the use of probabilities to predict inheritance patterns, real or virtual gel electrophoresis, and population simulations to predict population changes, safely, competently and methodically for the collection of valid and reliable data • Represent data in meaningful and useful ways, including the use of mean, median, range and probability; organise and analyse data to identify trends, patterns and relationships; discuss the ways in which measurement error, instrumental accuracy, the nature of the procedure and the sample size may influence uncertainty and limitations in data; and select, synthesise and use evidence to make and justify conclusions • Interpret a range of scientific and media texts, and evaluate models, processes, claims and conclusions by considering the quality of available evidence, and use reasoning to construct scientific arguments • Communicate to specific audiences and for specific purposes using appropriate language, nomenclature, genres and modes, including scientific reports	
1	2	*Heredity*	**Science Understanding SU1,2, 9** *Heredity* • Continuity of life requires the replication of genetic material and its transfer to the next generation through processes, including binary fission, mitosis, meiosis and fertilisation	

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			• DNA is a helical double-stranded molecule that occurs bound to proteins in chromosomes in the nucleus, and as unbound circular DNA in the cytosol of prokaryotes, and in the mitochondria and chloroplasts of eukaryotic cells • variations in the genotype of offspring arise as a result of the processes of meiosis, including crossing over and random assortment of chromosomes, and fertilisation, as well as a result of mutations	
1	3	*Heredity*	**Science Inquiry Skills SIS 6** • Select, construct and use appropriate representations, including models of DNA replication, transcription and translation, Punnett squares and allele frequencies in gene pools to communicate conceptual understanding, solve problems and make predictions **Science Understanding SU2, 3, 4** *Heredity* • DNA is a helical double-stranded molecule that occurs bound to proteins in chromosomes in the nucleus, and as unbound circular DNA in the cytosol of prokaryotes, and in mitochondria and chloroplasts of eukaryotic cells • The structural properties of the DNA molecule, including nucleotide composition and pairing and the hydrogen bonds between strands of DNA, allow for replication • The genetic code is a base triplet code; genes include 'coding' and 'non-coding' DNA, and many genes contain information for protein production	
1	4	*Heredity*	**Science Understanding SU 5, 6** *Heredity* • Protein synthesis involves transcription of a gene into messenger RNA in the nucleus, and translation into an amino acid sequence at the ribosome • Proteins, including enzymes and structural proteins, are essential to cell structure and functioning	

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1	5	*Heredity*	**Science Understanding SU 7, 8, 9** *Heredity* • The phenotypic expression of genes depends on the interaction of genes and the environment • Mutations in genes and chromosomes can result from errors in DNA replication or cell division, or from damage by physical or chemical factors in the environment • Variations in the genotype of offspring arise as a result of the processes of meiosis, including crossing over and random assortment of chromosomes, and fertilisation, as well as a result of mutations	**Task 1:** Test 1: The Genetic Code and DNA Technologies Reproduction and Patterns of Inheritance
1	6,7	*Heredity*	**Science Inquiry Skills SIS 6** • Select, construct and use appropriate representations, including Punnett squares, to communicate conceptual understanding, solve problems and make predictions **Science Understanding SU 10** *Heredity* • Frequencies of genotypes and phenotypes of offspring are determined by patterns of inheritance, including dominance, autosomal and sex-linked alleles, multiple alleles and polygenes	
1	8	**Science Inquiry Skills**	**Science Inquiry Skills SIS 3** • Conduct investigations, including the use of probabilities to predict inheritance patterns, real or virtual gel electrophoresis, and population simulations to predict population changes, safely, competently and methodically for the collection of valid and reliable data **Science as a Human Endeavour SHE 1** • Transgenic organisms have been engineered for desirable traits, including resistance, faster growth rate, greater product quality and yield, and tolerance to adverse environmental conditions **Science Understanding SU 11**	

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			Heredity • DNA sequencing enables mapping species genomes; DNA profiling identifies the unique genetic makeup of individuals	
1	9	**Science as a Human Endeavour** *Heredity*	**Science as a Human Endeavour SHE 1, 2, 3 ,5** • Transgenic organisms have been engineered for desirable traits, including resistance, faster growth rate, greater product quality and yield, and tolerance to adverse environmental conditions • Using transgenic organisms may have adverse effects on genetic diversity and the environment, including ‣ the effects on non-target organisms ‣ more rapid evolution of pesticide-resistant species ‣ the possibility of gene flow from crop species to weed species resulting in the emergence of 'super weeds' • Biotechnology can be used in environmental conservation for ‣ monitoring endangered species ‣ assessing gene pools for breeding programs ‣ quarantine • Conservation planning to maintain viable gene pools includes consideration of ‣ biogeography ‣ reproductive behaviour ‣ population dynamics **Science Understanding SU 12** *Heredity*	**Task 2: Science Inquiry** DNA Investigation: practical activity followed by a validation test

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			• Recombinant DNA technology and DNA identification technologies are applied in agriculture and environmental conservation	
2	1	*Continuity of life on Earth*	**Science as a Human Endeavour SHE 4** • Technological developments in the fields of comparative genomics, comparative biochemistry and bioinformatics have enabled identification of further evidence for evolutionary relationships **Science Understanding SU 13, 14, 15** *Continuity of life on Earth* • Life has existed on Earth for approximately 3.5 billion years and has changed and diversified over time • Evidence for the theory of evolution includes ‣ comparative genomics (molecular evidence) ‣ the fossil record ‣ comparative anatomy and embryology • Evolutionary relationships between groups can be represented using phylogenetic trees	**Task 3: Extended Response** Fossils and evolution
2	2	*Continuity of life on Earth*	**Science Understanding SU 16, 17, 18, 20** *Continuity of life on Earth* • Mutation is the ultimate source of genetic variation as it introduces new alleles into a population • Natural selection occurs when selection pressures in the environment confer a selective advantage on a specific phenotype to enhance its survival and reproduction; this results in changes in allele frequency in the gene pool of a population • In addition to environmental selection pressures, sexual selection, mutation, gene flow and genetic drift can contribute to changes in allele frequency in a population gene pool	

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			• Selective breeding (artificial selection) through the intentional reproduction of individuals with desirable characteristics results in changes in allele frequencies in the gene pools over time	
2	3	*Continuity of life on Earth*	**Science Understanding SU 19, 21, 22** *Continuity of life on Earth* • Speciation and macro-evolutionary changes result from an accumulation of micro-evolutionary changes over time • Differing selection pressures between geographically isolated populations may lead to allopatric speciation • Populations with reduced genetic diversity face increased risk of extinction	**Task 4:** Test 2: Continuity of life on Earth
2	4		Revision	
2	5		Past Exam paper revision	
2	6		Semester 1 examination Start Wednesday 26th May	**Task 5:** Semester 1 Exam – three hours using the examination design brief from the syllabus

Unit 4: Semester 2 Surviving in a changing environment

Term	Week	Topic	Key teaching points / Syllabus Content	Assessment
2	8	**Science Inquiry Skills** *Homeostasis*	**Science Inquiry Skills SIS 3** • Conduct investigations, including using models of homeostasis and disease transmission, safely, competently and methodically for valid and reliable collection of data **Science Understanding SU 1-3** *Homeostasis*	

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			• Homeostasis is the process by which the body maintains a relatively constant internal environment; it involves a stimulus–response model in which change in external or internal environmental conditions is detected and appropriate responses occur via negative feedback • Changes in an organism's metabolic activity, in addition to structural features and changes in physiological processes and behaviour, enable the organism to maintain its internal environment within tolerance limits (temperature, nitrogenous waste, water, salts, and gases) • Thermoregulatory mechanisms include structural features, behavioural responses and physiological mechanisms to control heat exchange and metabolic activity; animals can be endothermic or ectothermic	
2	9	*Homeostasis*	**Science Understanding SU 4,5** *Homeostasis* • The type of nitrogenous waste produced by different vertebrate groups can be related to the availability of water in the environment • Animals have a variety of behavioural, physiological and structural adaptations to maintain water and salt balance in terrestrial and aquatic environments	**Task 6: Science Inquiry** Temperature regulation in animals Investigation: practical activity followed by validation test
2	10, 11	*Homeostasis*	**Science Understanding SU 6** *Homeostasis* • To maintain water balance and allow for gas exchange, xerophytes and halophytes have a variety of structural and physiological adaptations	**Task 7:** Test 3: Homeostasis
3	1	*Infectious disease*	**Science Understanding SU 7-10** *Infectious disease* • Infectious disease differs from other disease in that it is caused by invasion by a pathogen and can be transmitted from one host to another	

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			• Zoonoses, such as influenza, can be transmitted between vertebrate species • The major groups of organisms that cause disease are bacteria, fungi, protists and viruses; each group can be distinguished by its structural characteristics • Diseases caused by these major pathogen groups include (Note: The Student Book introduces the diseases through the symptoms first.) ‣ tuberculosis, tetanus, crown gall of plants ‣ chytridiomycosis (amphibian chytrid fungus disease) ‣ malaria, Phytophthora dieback (jarrah dieback)* ‣ influenza, Ross River virus, viral diseases of honeybees, Australian bat lyssavirus * The Phylum Oomycota containing Phytophthora dieback has been removed from the Fungi Kingdom and placed in the Protista Kingdom	
3	2-3	*Infectious disease*	**Science Understanding SU 11** *Infectious disease* • The life cycle of a pathogen and its associated diseases, including the method of invading the host, the impact on the host, and the mode of transmission (direct or indirect), determines its success for survival	**Task 8: Extended Response** Disease
3	4	*Infectious disease* *Infectious disease*	**Science as a Human Endeavour SHE 1** • Susceptibility of urban areas to epidemics and pandemics of infectious disease can be due to population density, variation in living conditions and healthcare provisions **Science Understanding SU 12-15** *Infectious disease* • The spread of a specific disease involves a range of interrelated factors, including ‣ growth of the pathogen population	

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			‣ density of the host population ‣ mode of transmission • Transmission and spread of disease is facilitated by regional and global movement of organisms • The distribution of mosquito-borne diseases may be affected by global climatic changes • Many pathogens evolve rapidly in a changing environment	
3	5-6	*Infectious disease*	**Science as a Human Endeavour SHE 2-4** • Contemporary models can project the spread of disease and simulate the effects of possible interventions. Supercomputing has enabled models to predict the relationships between epidemic frequency and location, and factors such as population size, environmental change, persistence and antibiotic resistance • International cooperation and communication are needed to evaluate the risk of the spread of disease, including the emergence of new viral diseases • Quarantine measures protect Australia's agriculture industry and environment against the influx of disease-carrying materials and organisms in the face of increasing global trade and travel **Science Understanding SU 16** *Infectious disease* • Management strategies are used to control the spread of infectious diseases, including ‣ quarantine ‣ immunisation – herd immunity ‣ disruption of pathogen life cycle ‣ medications – antibiotics and antivirals ‣ physical preventative measures	**Task 9: Science Inquiry** Disease Outbreak Simulation with a written report
3	7	Revision	Revision	**Task 10:** Test 4: Infectious disease

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			• The life cycle of ‣ tuberculosis, tetanus, crown gall of plants ‣ chytridiomycosis (amphibian chytrid fungus disease) ‣ malaria, Phytophthora dieback (jarrah dieback)* ‣ influenza, Ross River virus, viral diseases of honeybees, Australian bat lyssavirus	
3	8	Revision	Past Exam Paper Revision	
3	9-10		Semester 2 examination (mock examination)	**Task 11:** Semester 2 Examination – three hours using the examination design brief from the syllabus