No. 102/2

EDUCATIONAL QUALITY AND ASSESSMENT PROGRAMME

Scoring Rubric 2020

South Pacific Form Seven Certificate

BIOLOGY

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Item #	Skill score	Evidence	Skill Level			
			1	2	3	4
STRAND 1 ANIMAL BEHAVIOUR						
1.1	1	Innate/natural/inborn behaviour	One correct idea stated			
1.2a	1	Kinesis: A ***behavioral response*** of a cell or an organism to a stimulus but ***not directionally oriented toward the source of stimulation***	One correct idea stated			
1.2b	2	Adaptive value of kinesis [benefit of kinesis] • Transfer from a less desirable location to a more desirable location. • Allows movement until favourable environment is reached • Organism receives information about its surrounding	One correct idea stated	Two or more correct ideas stated		
1.3	1	Zeitbeger	One correct idea stated			
1.4	1	Niche differentiation	One correct idea stated			
1.5	4	• Social Structure differentiated in structure, function, and behaviour into castes, - for queen: founder and leader (basic function reproduction) - drones: mate with queen - females - workers: builders • members cooperate in complex ways toward the common goal of the success of the colony, - most of them do not reproduce, energies directed elsewhere - Non-reproductive individuals help in the reproduction of their kin, who share and transmit their genes. - Such help is most favored when individuals can give more to their kin than they give up by not reproducing directly. - For example, they can remain at their natal site and help defend a valuable resource ("fortress defenders"), - or they can ensure that at least one adult survives to care for helpless young ("life insurers"). • Coping through: - Division of labour (reproduction, nutrition, communication, defence)	One correct idea stated	Two or more correct ideas stated	States two or more correct ideas; and there is integrating and linking of ideas	States two or more correct ideas; and there is integrating and linking of ideas so that a prediction of the future of social insects can be made

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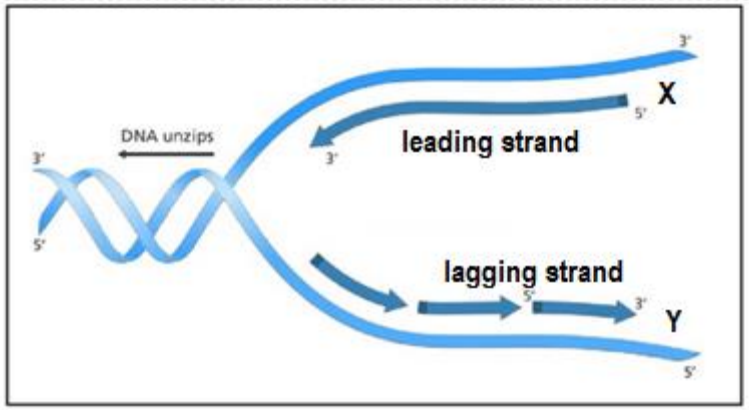
		- Unity and operating in the colony that it is seen as one organism - interdependence				
STRAND 2 GENE EXPRESSION						
2.1	1	Features of the human genome: • It is made up of 23 chromosome pairs/46 chromosomes • A total of about 3 billion DNA base pairs. •23 distinct human chromosome pairs: 22 autosomal, plus the sex-determining X and Y chromosomes •Chromosomes 1-22 are numbered roughly in order of decreasing size. •Somatic cells usually have one copy of chromosomes 1-22 from each parent, plus an X chromosome from the mother, and either an X or Y chromosome from the father, for a total of 46. •There are an estimated 20,000-25,000 human protein-coding genes.	One correct idea stated			
2.2	1		One correct idea stated			
2.3	1	Translation	One correct idea/cause stated			
2.4	2	Redundant nature of Genetic Code: • More than one codon codes for the an amino acid Examples • CAU and CAC for HIS; CAA and CAG for GLN • CGU, CGA, CGC, CGG for ARG	One correct idea/cause stated	Two or more correct ideas on the nature are stated		

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		• UAU, UAC for TYR; UAA, UAG and UGA for STOP • UGU and UGC for CYS				
2.5	2	Features of functional protein: • binding and transporting oxygen from the capillaries in the lungs to all of the tissues in the body • transport of carbon dioxide from the tissues of the body back to the lungs • Nitric oxide and carbon monoxide are also able to bind with hemoglobin, with carbon monoxide binding much more readily than oxygen (the reason why carbon monoxide poisoning is so serious).	One correct idea stated	Two or more correct ideas on the feature are stated		
2.6a	1	Define non- disjunction: • is the failure of homologous chromosomes or sister chromatids to separate properly during cell division.	One correct idea stated			
2.6b	2	Characteristics of polyploidy: • having more than 2n chromosome number • confers fertility on the formerly sterile hybrid, which thereby attains the status of a full species distinct from either of its parents. • Source of speciation for angiosperms	One correct idea stated	Two or more correct ideas stated		
2.6c	2	Characteristics of Downs Syndrome individual • Decreased or poor muscle tone • Short neck, with excess skin at the back of the neck • Flattened facial profile and nose • Small head, ears, and mouth • Upward slanting eyes, often with a skin fold that comes out from the upper eyelid and covers the inner corner of the eye • White spots on the colored part of the eye (called Brushfield spots) • Wide, short hands with short fingers • A single, deep, crease across the palm of the hand • A deep groove between the first and second toes	One correct idea stated	Two or more correct ideas stated		
2.7	3	• Missense codon: has a point mutation in one base/nucleotide resulting in the codon coding for a different amino acid • Nonsense codon: A **codon** which does not code for any amino acid, but signals a (premature) termination of translation, or punctuation. Results in a **Nonsense** mutation. A mutation which replaces a **codon** for an amino acid with a **codon** for chain termination (UAG, UAA, or UGA).	One correct idea stated	Two or more correct ideas stated	Two or more correct ideas stated and linked	

<table>
<tr><th rowspan="2">Item #</th><th rowspan="2">Skill score</th><th rowspan="2">Evidence</th><th colspan="4">Skill Level</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th></tr>
<tr><td></td><td></td><td>• Both result in mutations that can produce non-functional proteins leading disease/sickness or even death</td><td></td><td></td><td></td><td></td></tr>
<tr><td>2.8</td><td>1</td><td>Multiple Alleles – having three or more alternative forms of a gene (eg Blood type)</td><td>One correct idea stated</td><td></td><td></td><td></td></tr>
<tr><td>2.9</td><td>1</td><td>Feature of co-dominance
• neither allele can mask the expression of the other allele
• no dominant or recessive trait
• both alleles are expressed</td><td>One correct idea stated</td><td></td><td></td><td></td></tr>
<tr><td>2.10</td><td>3</td><td>Complementary genes:
• genes which complement the effects of the other, the presence of both genes needed for the expression of a certain phenotype
• Phenotype ratio is 9:7
• Dominant genes cannot produce independent traits
• Eg. purple flower and red eye in Drosophila

Supplementary genes:
• independent genes, both contribute to a single characteristic, where one gene can mask the effect of the other; one gene producing a characteristic and the second as only being able to 'supplement' this characteristic
• Phenotype ratio is 9:3:4
• Dominant genes can produce independent traits, different from the combined trait
• Eg. purple grain colour in maize, coat colour in mice</td><td>One correct idea stated</td><td>Two or more correct ideas stated</td><td>Two or more correct ideas stated and linked</td><td></td></tr>
<tr><td colspan="7">STRAND 3 BIOTECHNOLOGY APPLICATIONS</td></tr>
<tr><td>3.1a</td><td>1</td><td>Trans genesis (introducing a gene from one organism to genome of another)</td><td>One correct idea stated</td><td></td><td></td><td></td></tr>
<tr><td>3.1b</td><td>3</td><td>Impact of trans genesis on gene pool
<table><tr><th>Positive</th><th>Negative</th></tr><tr><td>• facilitating research in medicine</td><td>• reduce diversity due to superior nature thus outcompeting other spp</td></tr></table></td><td>One correct idea stated</td><td>Two or more correct ideas on how the process is implemented</td><td>States two or more correct ideas that explains and links to the impact</td><td></td></tr>
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			1	2	3	4
		• acquire new genes of advantage to organism • recombinants are of better quality • alleviating suffering and lack • developing risk issues relating to environmental safety/plant and animal safety				
3.2	1	Gel electrophoresis	One correct idea stated			
STRAND 4 PROCESSES AND PATTERNS OF EVOLUTION						
4.1a	1	Independent assortment states that the alleles of two (or more) different genes get sorted into gametes **independently** of one another.	One correct idea stated			
4.1b	3	<u>How independent assortment leads to variation</u> • When cells divide during meiosis, homologous chromosomes are randomly distributed to daughter cells, • different chromosomes segregate independently of each other into gametes. This is **independent assortment**. • It results in gametes that have unique combinations of chromosomes. • IA results in reshuffling of genes into unique combinations	One correct idea stated	Two or more correct ideas stated	States two or more correct ideas that explains how there is variation	
4.1c	1	Features of meiosis: • Reducing cell division process • Four daughter cells reproduced • Daughter cells are haploid (n) • Production of gametes • 2 stages	One correct idea stated			
4.2a	1	Selection pressure: external agents which affect an organism's ability to survive in a given environment	One correct idea stated			
4.2b	2	<u>Biotic:</u> Competition, predators, parasitism, pathogens, resource availability <u>Abiotic</u> Weather/temperature – related (floods, cyclones, tsunamis)	One correct idea stated	Two or more correct ideas stated		

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4,3	3	Role of humans in artificial selection • Selecting/choosing individuals for reproduction • Ensuring that the individuals have the desired trait • Implementing the reproductive process • Faster than natural selection – to obtain desired trait	One correct idea stated	Two or more correct ideas stated	Two or more correct ideas stated and explaining advantage or disadvantage	
4.4	1	Gene Pool • the stock of different genes in an interbreeding population. • Total sum of all genes in a interbreeding population	One correct idea stated on			
4.5	1	Genetic Drift • change in the frequency of an allele within a population over time. • Random change in allelic frequencies in a population	One correct idea stated			
4.6a	1	Hybrid sterility	One correct idea stated			
4.6b	2	Post Mating (pre-zygotic) isolating mechanisms • *Gametic incompatibility*. Sperm transfer takes place, but egg is not fertilized. • *Zygotic mortality*. Egg is fertilized, but zygote does not develop.	One correct idea stated			

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4.7	4	Discuss the impact of divergent evolution from a common ancestor to the formation of new species. In your response, you may i. Define divergent evolution ii. Describe mechanisms that are allow for speciation iii. Explain the impact of this evolution on the new species iv. Use appropriate examples to support your answer. i. **Divergent evolution** is the process whereby groups from the **same common ancestor evolve and accumulate differences, resulting in the formation of new species; may occur as a response to changes in abiotic factors**, such as a change in environmental conditions, or when a new niche becomes available/two closely related species gradually become more and more dissimilar/produced homologous structure ii. Mechanism for speciation: • works on the basis that there is variation within the *gene pool* of a *population* – variation means differing abilities to survive/adapt in specific locations. • If a reproductive barrier separates two groups within a population, different genes controlling for various aspects of an organism's ability to survive and reproduce increase or decrease in frequency as *gene flow* is restricted (due to barrier) • Adaptation to different niches – especially regarding food, habitat • Development of homologous structures depending on surrounding Example Darwins finches: They lived on varying diets and had beaks that differed in shape and size reflecting their diet iii. Impact of divergent evolution: • reduced competition among species since they **evolve** traits that make them explicitly suited to their habitat and ecological niche.	One correct idea stated	Two or more correct ideas stated	Two or more correct ideas stated with linkage between ideas.	Two or more correct ideas stated with linkage between ideas. Examples are used to support or justify the idea.

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		• Adaptation to change in environment situations/when a niche is created • maximizes that advantage until it becomes a normal part of their genetic makeup. • the act of diverging from an older species to become a new and (typically) better-equipped species				
STRAND 5 ENVIRONMENTAL ISSUES						
5.1	2	Activities that contribute to global temperature: • Burning fossil fuels (transport, industries, use of electrical appliances.) • Deforestation (farming and forestry) • Agricultural practices • Livestock • Use of Aerosols	One correct idea stated	Two or more correct ideas stated		
5.2a	1	Adaptation • Adapting to future climate to reduce our vulnerability to the harmful effects of climate change • any adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities	One correct idea stated			
5.2b	2	Ways of adapting to CC;	One correct idea stated	Two or more correct ideas		

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		• planting more trees/mangroves • water conservation • relocation • building sea walls • upgrading living conditions/infrastructure (housing, waste management) • invest in drought resistant crops		stated		