Biology marking guide and response

External assessment 2021

Combination response (92 marks)

Assessment objectives

This assessment instrument is used to determine student achievement in the following objectives:

1. describe and explain biodiversity, ecosystem dynamics, DNA, genes and the continuity of life, and the continuity of life on Earth

2. apply understanding of biodiversity, ecosystem dynamics, DNA, genes and the continuity of life, and the continuity of life on Earth

3. analyse evidence about biodiversity, ecosystem dynamics, DNA, genes and the continuity of life, and the continuity of life on Earth to identify trends, patterns, relationships, limitations or uncertainty

4. interpret evidence about biodiversity, ecosystem dynamics, DNA, genes and the continuity of life, and the continuity of life on Earth to draw conclusions based on analysis.

Note: Objectives 5, 6 and 7 are not assessed in this instrument.

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Purpose

This document consists of a marking guide and a sample response.

The marking guide:

- provides a tool for calibrating external assessment markers to ensure reliability of results
- indicates the correlation, for each question, between mark allocation and qualities at each level of the mark range
- informs schools and students about how marks are matched to qualities in student responses.

The sample response:

- demonstrates the qualities of a high-level response
- has been annotated using the marking guide.

Mark allocation

Where a response does not meet any of the descriptors for a question or a criterion, a mark of '0' will be recorded.

Where no response to a question has been made, a mark of 'N' will be recorded.

Allowing for FT error — refers to 'follow through', where an error in the prior section of working is used later in the response, a mark (or marks) for the rest of the response can be awarded so long as it still demonstrates the correct conceptual understanding or skill in the rest of the response.

Marking guide

Paper 1: Multiple choice

Question	Response
1	D
2	C
3	D
4	A
5	C
6	C
7	B
8	B
9	C
10	B
11	A
12	A
13	C
14	B
15	A
16	C
17	B
18	B
19	B
20	C

Paper 1: Short response

Q	Sample response	The response:
21	The features used to classify living things change as you go from the broader taxonomic level to the more specific. Kingdom is the most extensive, so the features encompass the widest variety of organisms, with features such as cell type and structure. Through the middle taxa, features become more specific, with an emphasis on minor shared similarities such as fur, body shape and leaf shape. At the species level, features such as teeth structure, body size, behaviour and distribution may be used, as well as the more recent use of biochemical similarities.	· states that the Linnaean system 　– starts with broad taxa that have major similarities **[1 mark]** 　– has lower taxa that become more specific, with minor similarities **[1 mark]** · provides a relevant example for broad taxa **[1 mark]** · provides a relevant example for mid **OR** narrow taxa **[1 mark]**
22	Atmospheric carbon exists mainly as carbon dioxide, which is transformed from carbon dioxide gas to produce glucose (and other complex organic molecules) via photosynthesis. This also covers the transfer from atmosphere to plants by diffusion. Respiration transforms glucose into carbon dioxide.	· states 1 transformation **[1 mark]** · states another transformation **[1 mark]** · states 1 transfer **[1 mark]**

Q	Sample response	The response:
23a)	Quadrats did not cover salt marsh area but transects were placed throughout the different strata. Quadrats sampled a smaller area of 40 m^2 compared to a larger area of 300 m^2 for transects. Bias was removed in quadrat sampling method by using random sampling, but it wasn't for transects.	· identifies first difference **[1 mark]** · identifies second difference **[1 mark]** · identifies third difference **[1 mark]**
23b)	The belt transect was most the most suitable method as it identified more species.	· concludes that the transect method was most suitable **[1 mark]** · gives a reason **[1 mark]**

24a)	Producers ➔ Primary consumers 10%
	Primary ➔ Secondary consumers 5%
	The ecosystem shows a drop in efficiency of transfer of biomass from 10% to 5%.
		· provides
		  – for producers to primary consumers, 10% **[1 mark]**
		  – for primary to secondary consumers, 5% **[1 mark]**
		· contrasts efficiency **[1 mark]**

24b)	As you move through to higher tropic levels, a higher proportion of the energy is lost to respiration and heat, and to decomposers. Overall, a smaller percentage is passed on to the next trophic level.	· states that higher trophic levels lose a higher proportion of their energy due to other processes **[1 mark]** · states at least one process **[1 mark]**

Q	Sample response	The response:
25	The genotypes of the parents are $I^A i$ and $I^B i$ Potential crosses |	I^A	i
I^B	$I^A I^B$	$I^B i$
i	$I^A i$	ii | ¼ type AB, ¼ type A, ¼ type B, ¼ type O	· identifies parents as $I^A i$ and $I^B i$ **[1 mark]** · shows appropriate working **[1 mark]** · states a consequentially correct frequency for each blood type **[1 mark]**
26a)	Phosphate, deoxyribose sugar and a nitrogenous base.	· states phosphate, sugar and a base **[1 mark]**

26b)	DNA samples are taken from two or more individuals and short sequences/STRs are identified and separated.
	The short fragments of DNA are then amplified using polymerase chain reaction (PCR).
	Results are compared by gel electrophoresis, so DNA similarities and differences between the samples and/or a known DNA profile can be determined.
		· describes
		  – one step **[1 mark]**
		  – a second step **[1 mark]**
		  – a third step **[1 mark]**

27	The phylogenetic tree is correct. In order of percentage differences compared to A, D is 10% different across the three gene regions, C is 13% different and B is 24% different.	· determines that the tree is correct **[1 mark]** · describes the order of percentage differences between species **[1 mark]** · provides relevant data from the table **[1 mark]**

28	Phase A: Population is low and resources are plentiful; maximum growth rate is observed; births consistently outnumber deaths.
	Phase B: Birth and death rates become balanced as population reaches carrying capacity.
		· refers to a feature of
		  – Phase A **[1 mark]**
		  – Phase B **[1 mark]**
		  – determines population growth model as logistic **[1 mark]**

Q	Sample response	The response:
	Population growth model: logistic	

Paper 2: Short response

Q	Sample response	The response:

1	An abiotic factor that would affect population would be temperature, because warmer water will evaporate faster, reducing the carrying capacity by limiting space.
	A biotic factor that would affect population would be food availability, because more food (e.g. algae or plankton) would result in a larger population of mosquito larvae.
		· states a
		  – relevant abiotic factor **[1 mark]**
		  – relevant biotic factor **[1 mark]**
		· explains the effect of the identified
		  – relevant abiotic factor **[1 mark]**
		  – relevant biotic factor **[1 mark]**

2a)	Exons are sequences of coding DNA, which is transcribed into mRNA and then translated into proteins. Introns are sequences of non-coding DNA and have a variety of other functions. They are spliced out of the mRNA prior to translation.	· states that exons are coding DNA and introns are non-coding DNA **[1 mark]** · explains that exons are transcribed into mRNA and then translated into proteins, whereas introns are spliced out of mRNA and have other functions **[1 mark]**
2b)	Telomeres protect the ends of chromosomes from being degraded, prolonging their life.	· states a function of telomeres **[1 mark]**

Q	Sample response	The response:
3	Features that make these plants effective colonisers of dunes are that they grow rapidly, their seeds are dispersed by the wind and they are tolerant of the extreme heat and dryness of the environment.	· identifies first feature **[1 mark]** · identifies second feature **[1 mark]** · identifies third feature **[1 mark]**
4	Polymerase chain reaction is used to amplify (i.e. make many copies) of a DNA template because usually only a small amount of DNA is available for analysis. For example, crime scene DNA is sometimes found only at trace levels. PCR amplifies this small amount to allow analysis to be carried out.	· explains purpose of PCR as amplifying a DNA sample for further analysis **[1 mark]** · provides an example **[1 mark]**

5	Crossing over: When segments of maternal and paternal chromosomes are exchanged during the process of meiosis, resulting in chromosomes containing DNA from each parent — new genetic combinations are produced at the chromosome level.
	
	Independent assortment: Maternal and paternal chromosomes do not separate together; instead, each haploid gamete cell will contain a mixture of chromosomes from each parent, providing new genetic combinations.
		· for crossing over
		  – provides the name of the process **[1 mark]**
		  – describes the process **[1 mark]**
		  – states how the process contributes to genetic variation in gametes **[1 mark]**
		· for independent assortment
		  – provides the name of the process **[1 mark]**
		  – describes the process **[1 mark]**
		  – states how the process contributes to genetic variation in gametes **[1 mark]**

Q	Sample response	The response:
6	Two limitations are: 1. Sometimes only fossil evidence is available, so a species may be differentiated based on physiological and morphological features. 2. In some areas, hybridisation of plants and animals occurs, yet they are different species.	· states a limitation **[1 mark]** · states another limitation **[1 mark]**
7	High genetic diversity may allow for some members of the population to survive diseases and later reproduce and pass on their resistance to increase the survivability of the population. However, inbreeding creates low genetic diversity, which makes koalas vulnerable to extinction due to disease.	· explains how genetic diversity can prevent extinction during rapid environmental change, e.g. disease **[1 mark]** · describes why koalas have low genetic diversity (inbreeding) **[1 mark]** · states that koalas are more vulnerable to extinction due to low genetic diversity **[1 mark]**

8	This is allopatric speciation, where populations of the same species are separated by barriers (island-like distribution, exclusion by competitors, geographical barriers) meaning that no exchange of genetic material is possible and gene flow is halted.
	Over many generations, mutation, natural selection and genetic drift result in genetic and phenotypic divergence until a new species is formed.
		· identifies the mode as allopatric speciation **[1 mark]**
		· describes two elements of allopatric speciation
		  – cessation of gene flow due to a barrier between population groups **[1 mark]**
		  – genetic drift over time until divergence **[1 mark]**

9	Initial allelic frequencies were B 0.55 and b 0.45. Allelic frequencies after 20 generations were B 0.3 and b 0.7. B decreased (from 0.55 to 0.3) and b increased (from 0.45 to 0.7). This selection pressure was in favour of white rabbits as both genotype and allelic frequencies shifted toward the white phenotype and the white allele.	· provides the correct initial and final allele frequencies **[1 mark]** · identifies consequentially correct change in allele frequency **[1 mark]** · states a consequentially valid conclusion **[1 mark]**

Q	Sample response	The response:
10	In eukaryotes, DNA occurs bound to histone proteins in chromosomes in the nucleus of eukaryotes or as unbound circular DNA in the mitochondria. It can also occur as unbound circular DNA in the cytosol of prokaryotic cells.	· describes one way DNA occurs in cells **[1 mark]** · describes a second way DNA occurs in cells **[1 mark]** · describes a third way DNA occurs in cells **[1 mark]**
11	Transcription factors either increase (activator) or decrease (repressor) the rate of transcription of a particular gene. For example, transcription factor A increases transcription for the intermediate cells to form, whereas it reduces the rate of or prevents compact bone formation.	· states that transcription factors can both increase and decrease transcription rates **[1 mark]** · provides a suitable example from the table **[1 mark]**

Q	Sample response	The response:
12a)	SDI $= 1 - (\dfrac{7(7-1)+3(3-1)+88(88-1)}{98(98-1)})$ $= 0.19$	· shows substitution correctly performed **[1 mark]** · determines SDI = 0.19 **[1 mark]**
12b)	Area 2 has lower SDI than Area 1. While the communities' total populations are similar (94 to 98), Area 2 has a species that is dominant (Yellow mangroves) which causes the SDI in Area 2 to be much lower than Area 1.	· states a relevant similarity **[1 mark]** · states a relevant difference **[1 mark]** · states the significance of the identified differences **[1 mark]**

Q	Sample response	The response:
13	It is likely that no further ecological succession would occur — this appears to be a climax community as there is levelling in the biomass and biodiversity, a range of shrubs, trees and grasses with mature trees making up a large proportion of the community and the dominant species are K-selected (mature trees).	· predicts no further succession **[1 mark]** · provides a relevant reason **[1 mark]** · provides another relevant reason **[1 mark]**