Biology marking guide

External assessment

Combination response (90 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.

Purpose

This document is an External assessment marking guide (EAMG).

The EAMG:

- 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.

Mark allocation

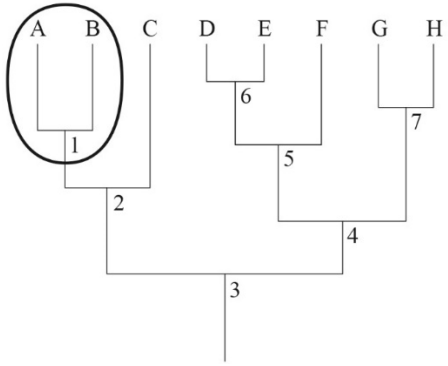
Where a response does not meet any of the descriptors for a question or a criterion, a mark of ‘0’ will be recorded. Where no response to a question has been made, a mark of ‘N’ will be recorded.

External assessment marking guide (EAMG)

Multiple choice (20 marks)

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

Short response (25 marks)

Q		Sample response	The response:
21		$\%\ abundance = \frac{no.\ individuals\ for\ species\ B}{no.\ individuals\ for\ all\ species} \times 100$ $\%\ abundance = \frac{35}{50 + 35 + 10 + 20 + 25} \times 100$ $\%\ abundance = \frac{35}{140} \times 100$ $= 25\%$	• shows accurate substitution **[1 mark]** • states 25% **[1 mark]**
22	a)	A clade is a group of organisms that consists of a common ancestor and all its lineal descendants.  	• states that a clade is a group of organisms that consists of a common ancestor and all its lineal descendants **[1 mark]** • identifies a clade **[1 mark]**
22	b)	Node 4	• states node 4 **[1 mark]**
22	c)	D and E	• states D and E **[1 mark]**

Q		Sample response	The response:
23		r-selected species generally have a high number of offspring whereas K-selected species have a low number. r-selected species have less parental care or involvement with offspring whereas K-selected species have high care. r-selected species have shorter lifespans whereas K-selected species have longer lifespans.	• describes r-selected as high number of offspring and K-selected as low number of offspring **[1 mark]** • describes r-selected as low care and K-selected as high care **[1 mark]** • describes r-selected as short lifespan and K-selection as long lifespan **[1 mark]**
24	a)	Genotype refers to the combination of alleles that an organism has.	• states combination of alleles **[1 mark]**
24	b)	The parent of the offspring would have a mutation that is inheritable (in sex organs) and creates a new allele (variation of a gene). The genotype of an offspring may then be affected as it would contain new alleles if the mutated gene from an egg or sperm is present in the zygote at fertilisation. This will then affect the genotype of the offspring.	• states a description of the mutation being a new allele of a gene **[1 mark]** • states genotype contains new alleles if/when inherited **[1 mark]**

Q		Sample response	The response:
25	a)	Producers 52 – 16 – 8 = 28 MJ/m^2/year Herbivores 28 – 20 – 5 = 3 MJ/m^2/year	• states 28 MJ/m^2/year for producers **[1 mark]** • states 3 MJ/m^2/year for herbivores **[1 mark]**
25	b)	Respiration was higher for the herbivores. Decomposition was higher for the producers.	• identifies 1 relevant difference between respiration and decomposition **[1 mark]** • identifies another relevant difference between respiration and decomposition **[1 mark]** **OR** • determines % loss at each trophic level 24/52 = 46% for producers 25/28 = 89% for herbivores **[1 mark]** • identifies % loss is higher for herbivores than autotrophs **[1 mark]**
26		Microevolution is the small-scale variation of allele frequencies within a species or population, in which the descendant is of the same taxonomic group as the ancestor.	• states small-scale variation of allele frequencies within a species or population, in which the descendant is of the same taxonomic group as the ancestor **[1 mark]**

Q		Sample response	The response:
27	a)	Coevolution	• states coevolution **[1 mark]**
27	b)	The increased ability for crabs to crush shells acts as a selection pressure on the prey and the stronger shells on the snails acts as a selection pressure on the crabs. Within the crab population, some will have stronger claws and be more successful in preying on the snails, and within the snail population, some will have stronger shells and resist predation — these are both selection advantages. This means that the population will gain a higher proportion of the genes that lead to claw strength or shell strength and, therefore, the population gains phenotypic resistance.	• states the selection pressures **[1 mark]** • describes variation in claw strength and shell strength occurring in both populations **[1 mark]** • describes the individuals with the selection advantage surviving and passing on the genes/traits to the next generation **[1 mark]**

Q	Sample response	The response:
28	Primary succession (e.g. after a volcanic eruption) begins with a bare site that hasn't been colonised before, whereas in secondary succession (e.g. a forest after a fire), the environment was previously colonised, but disturbed or damaged. A second difference is that in primary succession, a pioneer community is required to make the habitat fertile, whereas in secondary succession, the habitat is fertile with soil, seeds and remnants of vegetation.	• identifies one difference between primary and secondary succession **[1 mark]** • identifies a second difference between primary and secondary succession **[1 mark]** • provides an example of primary succession **[1 mark]** • provides an example of secondary succession **[1 mark]**

Combined response (45 marks)

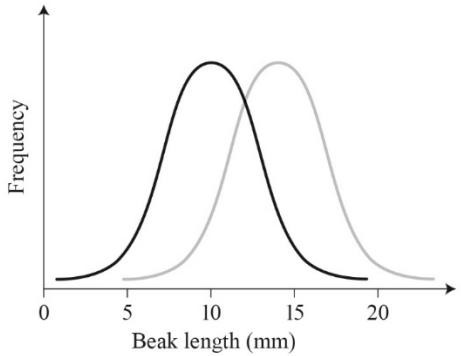
Q		Sample response	The response:
1	a)	Symbiosis is an interspecific interaction in which the species live together in a long-term relationship.	• states that the interaction is - between different species **[1 mark]** - long-term **[1 mark]**
1	b)	Mutualism means that both species benefit from the interaction. An example is the relationship between zooxanthellae (photosynthesis producing nutrients for coral) and coral polyps (hosting the zooxanthellae, providing home).	• describes mutualism **[1 mark]** • describes a relevant example where each organism benefits **[1 mark]**
2	a)	The competitive exclusion principle, which states that two species cannot occupy the same niche at the same time.	• states competitive exclusion **[1 mark]** • describes that two species cannot occupy the same niche simultaneously **[1 mark]**
2	b)	Species A would have had an advantage over Species B, as it is better able to compete for the same resource. This can be identified in test tubes 1 and 2 where after 4 days the population was higher for A, possibly indicating a higher rate of reproduction. Therefore, A would have outcompeted B for the same algal food source available, algae, and after 4 days the population was not sustainable for B and they all died. Species A's numbers were lower after 4 days due to the competition for the same resource.	• identifies that - Species A and B competed for the same resource **[1 mark]** - Species A outcompeted Species B **[1 mark]** - Species A's population was affected by the competition **[1 mark]**

Q		Sample response	The response:	
3		Helicase unzips the DNA molecule by breaking the weak hydrogen bonds between the two complementary strands. This creates a replication fork region so that bases are exposed. DNA polymerase uses each original strand as a template to produce a copy of the DNA molecule, and adds complementary nucleotides to the exposed bases. DNA polymerase also proofreads the newly synthesised strand.	• states helicase's role in - unzipping DNA **[1 mark]** - exposing bases **[1 mark]** • states DNA polymerase's role in - adding complementary nucleotides to the exposed bases **[1 mark]** • states another role of helicase, polymerase, or suitable feature of the process **[1 mark]**	
4	a)	$\text{SDI} = 1 - \frac{77(77-1) + 14(14-1) + 8(8-1)}{99(99-1)}$ $= 0.37$	• demonstrates correct substitution **[1 mark]** • states SDI = 0.37 **[1 mark]**	
4	b)	Belt transects are used for abundance and distribution of species. Random quadrats can be used for abundance, not distribution, and line transects can be used for distribution, not abundance. Random sampling doesn't take into account strata (different areas) and may not cover all areas of habitat equally, giving inaccurate measures of diversity and abundance.	• states 3 reasons	3 marks
			• states 2 reasons	2 marks
			• states a reason	1 mark
			• does not satisfy any of the descriptors above.	0

Q		Sample response	The response:
4	c)	The locations of belt transects were chosen to take strata into account.	• states a way to minimise bias **[1 mark]**
5		Transcription involves copying a gene's DNA sequence to make an RNA molecule. This is performed by enzymes called RNA polymerases, which link nucleotides to form an mRNA strand. In the translation process, the mRNA formed in transcription is transported out of the nucleus to the ribosome. Here, it directs protein synthesis. The mRNA passes through the ribosome and tRNA interacts with it, adding amino acids together to make a protein chain.	• states that in transcription - DNA is copied **[1 mark]** - mRNA is formed **[1 mark]** • states that in translation - mRNA is transported to ribosome **[1 mark]** - tRNA adds amino acids to form a protein chain **[1 mark]**
6	a)	Food availability	• identifies a resource or service of an ecosystem **[1 mark]**

Q		Sample response	The response:
6	b)	A future limiting factor, negatively affecting the carrying capacity, could include development on the island (new villas, roads etc. taking away space for the curlew's nesting sites).	• describes a relevant cause **[1 mark]** • discusses the relevant consequence **[1 mark]**

Q	Sample response	The response:
7	S = 6/√100 = 6/10 = 0.6 Community B has greater richness than Community A. Community B has a same number of different species as Community A (i.e. 6); however, Community A must have been for a larger sample.	• states that S = 0.6 **[1 mark]** • states that Community B has greater richness than Community A **[1 mark]** • states that Community A and Community B have same number of species **[1 mark]** • infers that Community B's sample size is smaller than Community A **[1 mark]**
8	Initially there is a rapid increase in growth. This is followed by a sudden drop in population numbers. This pattern is typical for J-curve population growth.	• states initial rapid population increase **[1 mark]** • states sudden population drop **[1 mark]** • states J-curve **[1 mark]**
9	In a population, some individuals will have inherited traits that help them survive and reproduce. Because the helpful traits are heritable, and because organisms with these traits leave more offspring, the population will become adapted to its environment. In the case of the lung fish, if the environment remains relatively unchanged (i.e. no new predators or competitors, still a water-dwelling organism), there is no environmental selection pressure to select for any new mutations in morphology, so there is minimal change in the species.	• describes natural selection in terms of - natural variation in a population includes traits that may be positive for survival in a given environment **[1 mark]** - states that these traits survive in the population if there is a selection pressure **[1 mark]** • with reference to the lung fish - states that the environment must have been relatively unchanged as no new morphological traits have been selected **[1 mark]**

Q		Sample response	The response:
10	a)	Directional selection is a mode of natural selection in which an extreme phenotype is favoured over other phenotypes, causing the allele frequency to shift over time in the direction of that phenotype.	• states directional selection as when - an extreme phenotype is favoured in a population **[1 mark]** - population shifts to have more individuals with the phenotype **[1 mark]**
10	b)		• sketch indicates shift to longer beak length **[1 mark]**

Q	Sample response	The response:	
11	At time point I, there is equal gene flow and equal allelic frequency in all niches, indicating a high degree of interbreeding between all niches. Trends show that the niche labelled as D has a progressive decrease in allelic frequency of the gene from time point I to time point III. This is supported by gene flow halting between C and D at time point II and then further from B to D at time point III. Gene flow between niches A, B and C remains constant throughout all time points, as shown by the arrows and also by the constant allelic frequency. This evidence supports a potential speciation event at niche D. Niche D however is not totally isolated as there remains some gene flow to the other populations (through niche A). This excludes allopatric speciation as the mode of proposed speciation. There is however an element of population isolation through niches, which supports parapatric speciation over sympatric speciation.	• identifies 3 pieces of evidence of speciation • infers that speciation is not allopatric because D is not isolated, e.g. at III, there is still gene flow with niche A • concludes that parapatric speciation occurred at D	6 marks
		• identifies 3 pieces of evidence of speciation • concludes that parapatric speciation occurred at D	5 marks
		• identifies 2 pieces of evidence of speciation • concludes that parapatric speciation occurred	4 marks
		• identifies 2 pieces of evidence of speciation • concludes that speciation occurred at D **OR** • identifies 3 pieces of evidence of speciation	3 marks
		• identifies 2 pieces of evidence of speciation	2 marks
		• concludes that parapatric speciation has occurred **OR** • concludes that speciation occurred at D	1 mark

Q	Sample response	The response:	
		• does not satisfy any of the descriptors above.	0