VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2009 Biology GA 3: Written examination

GENERAL COMMENTS

Students need to use their time efficiently, in particular by using the reading time to analyse the Section B questions and begin the complex thought processes required to answer these questions adequately. Suggested timing is given on the examination paper: 30 minutes for Section A – Multiple-choice questions and 1 hour for Section B – Written responses. If students spend too long on the multiple-choice section their answers to the written section will suffer. The quality of the responses provided by many students was excellent. These students interpreted and answered the questions in a clear and logical fashion. However, questions that required explanations or analysis still caused difficulty for many students. It is important that students follow any suggestions or requirements given within a question. The marks allocated to each question and the space provided for the answer were a guide to the amount of information required in a response.

Students were awarded full marks when their answers were clearly expressed and the information included was organised logically and addressed the question directly. Too often students gave answers in the incorrect part of a question and repeated themselves in questions that followed.

Students must, as usual, endeavour to spell and use common biological terms correctly. Any ambiguous terms should be avoided.

Students are strongly recommended to complete Section B in pen, as responses in pencil are often difficult to read and interpret. It is most pleasing to report that the minimal usage of pencil in Section B has continued. This improved the clarity of the writing and consequently the ease of marking. It is important to note that if a student starts writing in pencil and then remembers the instruction, there is no need to go over the answers in pen.

SPECIFIC INFORMATION

Section A – Multiple-choice questions

The table below indicates the percentage of students who chose each option. The correct answer is indicated by shading.

Question	% A	% B	% C	% D	Comments
1	2	23	18	58	
2	84	4	11	0	
3	15	20	56	9	In human meiosis, four daughter cells are produced; however, not all cells form gametes due to production of Barr bodies. Hence option C was incorrect.
4	7	3	88	2	
5	3	3	37	58	
6	7	18	50	23	This question involved a dihybrid cross, an area of the *VCE Biology Study Design* which causes difficulty for many students. Option B was incorrect as it should be a one in four chance. Option D was incorrect as it is a one in eight chance. The stem of the question indicated that cats which are heterozygous at the S locus have less white fur.
7	3	16	31	50	The Meisham sows, when crossbred with British males, would be able to accommodate the litter of the hybrid offspring comfortably as they have 18 teats. If the converse mating occurred there may be far more offspring than teats.
8	16	1	9	74	
9	15	64	3	19	
10	8	18	52	23	The diagram showed a double-stranded molecule, DNA, being copied into a single-stranded molecule, mRNA. This is catalysed by the enzyme RNA polymerase.
11	3	1	77	18	

Question	% A	% B	% C	% D	Comments
12	4	30	5	61	Darwin's ideas on evolution (by the process of natural selection) hinge on the notion that some members of a species (those suited) produce more offspring than others. Response C was incorrect. Darwin also recognised that offspring tend to resemble their parents (characteristics are inherited). Response D was incorrect as this was a Lamarckian statement.
13	7	7	83	3	
14	28	67	3	2	
15	9	3	7	81	
16	11	77	11	1	
17	16	56	19	9	
18	90	6	1	3	
19	10	59	10	21	
20	10	11	46	32	As prokaryotes have a single circular chromosome, the operon is located on this chromosome. Plasmids are not involved in the process outlined. Response D was incorrect as the stem of the question stated that regulator genes in eukaryotes may be on different chromosomes and hence a mutation in a regulator gene **would** have an effect.
21	8	3	2	87	
22	26	12	3	59	
23	45	46	7	2	Genetic drift is the change in allele frequencies due to chance and is evident in small isolated populations. There was no mention of selective pressures and the experiment was done in a controlled environment, hence natural selection would not be occurring.
24	58	5	6	31	
25	6	40	38	14	The sterile hybrid plant would contain 18 non-homologous chromosomes – 9 from each parent. When two cells are fused, the resultant cell contains 36 chromosomes and there would be 18 homologous pairs – 9 from each parent.

Section B – Short-answer questions

For each question, an outline or examples of the correct answer(s) is provided. In some cases the answer given is not the only answer that could have been awarded marks.

Question 1a.

Marks	0	1	Average
%	82	18	**0.2**

Cell division occurring in bacteria/prokaryotes producing two daughter cells

The statement had to distinguish the process from other types of cell division. This question was poorly answered. Some students incorrectly referred to binary fission as **mitosis** in bacterial cells or stated it was the division of the bacterial nucleus.

Question 1b.

Marks	0	1	Average
%	67	33	**0.4**

W and either of:

- the chromosomes are visible
- it is showing anaphase of mitosis.

Some students thought the cell cycle illustrated indicated the separate phases of mitosis and consequently chose the incorrect letter. Other students gave the wrong phase, such as telophase.

Question 1c.

Marks	0	1	Average
%	45	55	**0.6**

Either of:

- a fault has occurred such as spindles break or chromosomes fail to separate
- cells produced are unable to function/not required.

Question 1d.

Marks	0	1	2	3	Average
%	39	15	16	30	**1.4**

All of:

- mRNA travels to the ribosomes where its codons are read
- tRNA carries specific amino acids to the ribosomes **or** complementary base pairing occurs between the codons and anticodons
- product; protein/polypeptide.

This question was well answered by many students. However, some students failed to name the final product, which was specifically asked for in the question. Other students used many irrelevant terms, enzymes and structures which detracted from their answers.

Question 2a.

Marks	0	1	Average
%	53	47	**0.5**

¼ or 25% or any other appropriate form

1:3 was an acceptable answer; however, 1:4 and 3:1 were incorrect. Students are advised not to use ratios unless they are specifically asked for in the question.

Question 2b.

Marks	0	1	Average
%	8	92	**0.9**

Both of:

- non-identical twins
- they have different genotypes for the given gene loci.

This question was well answered by most students; however, a common incorrect answer was 'the twins had different phenotypes'. This was not correct as the environment is responsible for the expression of the genotype and would not be used to determine the type of twin.

Question 2c.

Marks	0	1	2	Average
%	16	30	54	**1.4**

Two of:

- Max is not able to convert phenylalanine to tyrosine **or** Jack can convert phenylalanine to tyrosine
- Jack is albino/does not produce melanin **or** Max is pigmented
- Max has higher levels of phenylpyruvic acid than Jack
- any other suitable phenotypic difference.

This question was well answered; however, some students gave incorrect information or did not give the correct name of the twin.

Question 2di-ii.

Marks	0	1	2	3	Average
%	41	21	23	16	**1.2**

2di.
A test cross should be performed; for example, by using a plant which is homozygous recessive for the phenotypes under consideration, genotype bbgg. The cross would therefore be BbGg X bbgg and the offspring produced would have the following genotypes, phenotypes and ratios: 1 BbGg normal stalk, green; 1 Bbgg normal stalk, yellow; 1 bbGg brittle stalk, yellow; 1 bbgg brittle stalk, green.

Credit was given to students if they could identify a cross which would produce offspring with the homozygous recessive phenotype and if they were able to infer that the particular plant was heterozygous.

2dii.
The cross given above in Question 2di. is for genes located on different chromosomes; therefore, if the offspring was not produced in the same ratio, it could be inferred that the genes were on the same chromosome (linked).

This question could have been answered in many different ways and this was taken into account during assessment. This was a difficult question; however, students who set out their answer logically and clearly gained full marks. It was evident from many answers that gene linkage was not well understood.

Question 3ai-ii.

Marks	0	1	2	Average
%	5	68	27	**1.2**

3ai.
Variety of (pea) plant

A common incorrect answer was the height of the plant. Even though this variable appears on the *x*-axis, it is the dependant variable.

3aii.
One of:

- amount of (sun)light
- availability of water
- temperature.

Most students could identify an environmental variable; however, some gave vague answers such as ‘climate’, which were not awarded any marks.

Question 3b.

Marks	0	1	Average
%	65	35	**0.4**

9 cm

This question was clear in its requirements; however, many confused answers were given. A common incorrect answer was 5 cm; however, this is the height difference between the most numerous of each species, not the difference between the tallest – Palma: 31 cm, Vaspa: 22 cm.

Question 3c.

Marks	0	1	2	Average
%	22	46	33	**1.1**

Both of:

- many genes
- shows continuous variation.

Question 3d.

Marks	0	1	Average
%	55	45	**0.5**

The sum of alleles within a given population

The term 'gene pool' was not well understood. It is incorrect to state that it is the genes in a population. Incorrect responses given by students included variation (this could be environmental), genotypes, allele frequency or traits in a population, or the sum of alleles in an individual, species or community.

Question 3e.

Marks	0	1	2	Average
%	33	33	34	**1**

Both of:

- increase in genetic diversity/variation
- the greater the variation within a species, the more likely it is able to survive a change in the environment.

Many students did reasonably well on this question; however, many did not take the consequences of genetic variation to completion, for example, 'to help the possums survive' was deemed too vague to be awarded the mark.

Questions 4ai-ii.

Marks	0	1	2	3	Average
%	32	35	23	10	**1.1**

4ai.

The bird was rapidly covered by sediment, and one of:

- hidden from scavengers
- decreased rate of decomposition
- undisturbed
- long time.

This question was poorly answered. Too many students stated that the fossil was buried under rock or lava. The sediments, over time, form rock.

4aii.

Both of:

- stratigraphy is where layers of sediment build up over time
- the oldest fossils are found in the lowest stratum (or the converse).

Students could also have suggested radioisotopic dating and described how the sequence could be determined. If students answered in this way it was difficult to gain marks as they did not relate their answer to the sequencing.

Question 4bi-ii.

Marks	0	1	2	3	4	Average
%	26	18	23	25	8	**1.7**

4bi.

Mountain range/dry ground/road/or any other suitable answer

A common incorrect answer was geographic isolation.

4bii.

All of:

- the two separated populations have different gene pools/genetic variation/mutations present
- different selection pressures/environments/natural selection acts on each population
- if the two populations, when brought together, do not produce fertile offspring, they are different species

Many students were able to gain three marks for this question. They set out clear and logical answers, taking advice from previous Assessment Reports. The question allowed for a broad range of responses.

Too often students incorrectly wrote that 'the environment caused mutations which were advantageous'. Unlike similar questions in past examinations, students were able to choose their own example of an isolation barrier and describe speciation in general terms.

Question 5a.

Marks	0	1	Average
%	58	42	**0.4**

The characteristic is controlled by many genes or is an example of polygenic inheritance.

This was not an example of multiple alleles.

Question 5b.

Marks	0	1	Average
%	57	43	**0.5**

The chemical code is identical/very similar.

Some students stated that the code was 'similar', which was not precise enough. Answers which made inferences on evolutionary relationships were not awarded any marks as they were not addressing the question. Some students added 'due to the universal nature of DNA'; however, this was incorrect.

Question 5ci-iii.

Marks	0	1	2	3	Average
%	18	43	30	9	**1.3**

5ci.
A circle was to be drawn

5cii.
Either of:

- the centromere was required for spindles to attach
- to allow mitosis to occur.

5ciii.
Gene cloning

Gene replication and DNA replication were also accepted. PCR and transcription were incorrect answers and replication was deemed too vague.

Question 5di-ii.

Marks	0	1	2	3	Average
%	39	25	16	20	**1.2**

5di.
Both of:

- heterozygous
- it has different alleles (sequences).

To gain the mark students had to state 'heterozygous' and identify the reason for their choice.

5dii.
Two bands needed to be illustrated:

- near but slightly above 100
- near but slightly above 50.

Some students included extra bands or only one band, indicating that the DNA had not been cut.

Question 5e.

Marks	0	1	Average
%	52	48	**0.5**

The electrode had been connected the wrong way.

Common incorrect answers referred to contamination or not using a restriction enzyme.

Question 6a.

Marks	0	1	Average
%	53	47	**0.5**

Any of:

- big toe is arranged parallel to other toes
- big toe is not opposable
- prints indicate two feet, not four, or the use of hands/knuckles.

Question 6b.

Marks	0	1	2	Average
%	21	26	52	**1.3**

Set 2 and two of:

- prominent brow ridge
- smaller cranial capacity
- face protrudes more
- foramen magnum is positioned further back.

Some students gave too much information, some of which was incorrect. It is advisable that students give their best answer first. Students should only give the number of reasons asked for in the question.

Questions 6c.

Marks	0	1	Average
%	27	73	**0.8**

Evidence of:

- tools
- use of fire.

Question 6di-iii.

Marks	0	1	2	3	Average
%	31	33	26	11	**1.2**

6di.

Articulate speech/writing/painting/ceremonies enabled information to be passed on.

6dii.

Any of:

- the brain – an increase in capacity leads to greater processing of information
- precision grip led to the ability to make tools for fine manipulation
- structures involved with speech led to communication through speech.

6diii.

- yes – medical advances or genetic manipulation mean that modern humans are interfering in their own selection to the extent that natural selection no longer operates
- no – humans still exist in many different environments and are still subjected to different selective pressures, for example, disease

Students could argue either for or against the statement; however, a mark was only awarded if a reasoned argument was presented.

Question 6 was attempted by nearly all students and with some degree of success.

Question 7a.

Marks	0	1	Average
%	79	21	**0.2**

A single-stranded segment of DNA which is (radioactively) labelled

It was important that students' answers distinguished a probe from a primer. It was clear that the concept of a probe was not well understood.

Question 7b.

Marks	0	1	2	Average
%	31	43	27	**1**

Both of:

- green – indicates hybridisation with a normal allele
- red – indicates a specific mutation and hybridisation with that allele have occurred.

This was essentially a comprehension question.

Questions 7c.

Marks	0	1	Average
%	87	13	**0.2**

The joining of complementary DNA from different sources

Question 7d.

Marks	0	1	Average
%	75	25	**0.3**

G was replaced by A

A point mutation occurred. The specific type of mutation was a base substitution; however, in light of the data, the best answer was: G was replaced by A.

Question 7e.

Marks	0	1	Average
%	80	20	**0.2**

Either of:

- green if she inherited a normal allele from her mother
- red if she inherited the defective allele from her mother.

Students struggled to read and interpret this question.