2007 Assessment Report

VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2007 Biology GA 3: Written examination

GENERAL COMMENTS

The quality of the responses provided by some students was excellent; however, questions that required explanations or analyses still caused difficulty for many students. Students are encouraged to use the reading time to read Section B carefully, noting how many marks are allocated to each question as a guide to both the amount of time and amount of information required for each question. It is also important that students follow any suggestions or requirements that are given within a question; for example, Question 3 in Section B.

The marks for each question were a guide to the amount of information required in a response. Students were more likely to be awarded full marks for a question when their answers were clearly expressed and the information included was organised logically and addressed the question directly.

Students must endeavour to correctly spell and use common biological terms such as meiosis and guanine. Any ambiguous terms should be avoided.

Students are strongly recommended to follow the instruction to answer Section B in pen. The use of pencils in Section B is strongly discouraged as responses are often difficult to read and interpret.

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	4	77	5	13	
2	11	6	82	1	
3	26	12	10	51	
4	27	42	2	29	Prior to any cell division, the DNA replicates in the S phase of interphase; therefore, before meiosis occurs there would be 28 molecules.
5	40	9	39	11	From the diagram and the description it can be inferred that the organism represented by the fossil is a transitional form. Coevolution is a term used when two groups evolve, dependent on each other.
6	10	73	9	8	
7	3	24	54	19	All students were awarded one mark for this question. The intended answer was option C; however, the wording of this option was ambiguous and should have been 'changes more slowly than nuclear DNA'.
8	3	3	92	2	
9	12	17	27	45	
10	6	65	12	17	
11	25	68	4	3	
12	83	4	4	8	
13	6	9	7	78	
14	53	13	20	14	
15	79	5	7	9	
16	3	13	77	8	
17	10	52	18	20	
18	7	15	43	35	The stem of the question describes the carriage of debris by flood water, which is subsequently covered by fine sediment. It is therefore impossible to say that the plants and animals lived in the same habitat (option C) as it is uncertain where they originated.
19	68	10	15	7	

Question	% A	% B	% C	% D	Comments
20	10	6	81	3	
21	18	70	6	5	
22	7	2	23	68	
23	19	19	45	16	
24	23	7	23	47	The most complex social activity given is burial ceremonies (option A); these would require articulate speech to be effective. Organised hunting (option D) could be achieved using visual cues and gestures. Many animals, such as dogs, hunt prey in a coordinated fashion without articulate speech.
25	11	26	41	22	The treatment referred to is the application of modified bacteria to the soil around plants, in order to destroy *Agrobacterium tumefaciens*. It is important that the plasmid transfer gene is removed (option D) so that *A. radiobacter* is not able to transfer the antibiotic resistance gene to *Agrobacterium tumefaciens*.

Section B – Short-answer questions

For each question, an outline answer (or answers) is provided. In some cases the answer given is not the only answer that could have been awarded marks. General comments are made at the end of each part or question.

Question 1

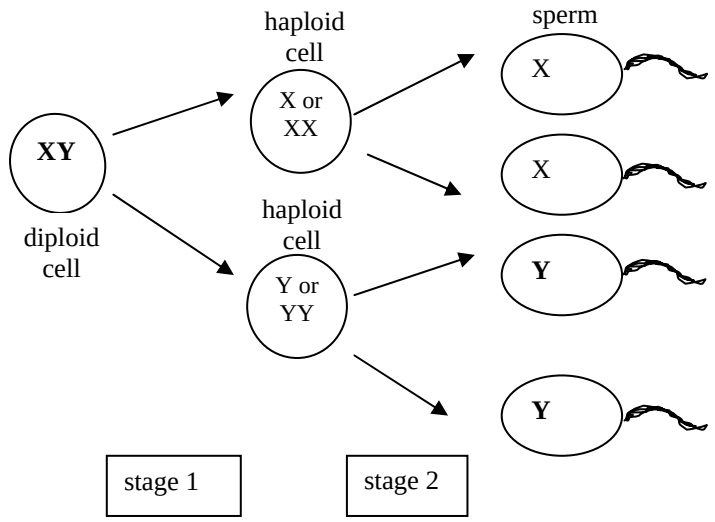
Question 1a–b.

Marks	0	1	2	Average
%	12	43	46	**1.4**

Question 1a.

Meiosis

Question 1b.



A common error was for students to put X and Y in each cell at stage 1.

Question 1c.

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

The sex chromosomes failed to separate (non-disjunction during the first stage of meiosis (anaphase 1)).

Question 1d.

Marks	0	1	Average
%	63	37	**0.4**

47

Question 1e.

Marks	0	1	Average
%	90	10	**0.1**

There was non-disjunction of the chromatids in stage 2 of meiosis.

It was most pleasing to see that students could identify and correctly name meiosis in Question 1a. Many students recognised that the process of non-disjunction was responsible for the abnormal chromosome arrangements; however, some common errors were that some students thought it was total non-disjunction or that chromosomes, incorrectly, separate during stage 2 of meiosis.

Questions 2
Question 2a.

Marks	0	1	Average
%	29	71	**0.7**

PCR (or Polymerase Chain Reaction)

Question 2b.

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

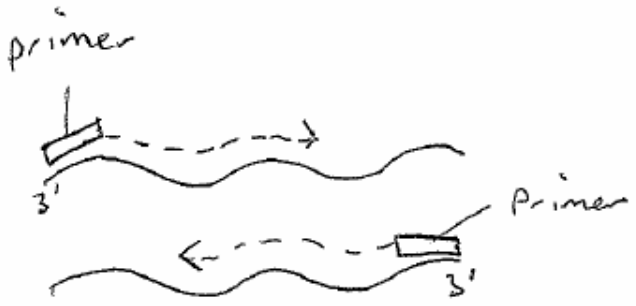
Heating:

- to 90°C or greater
- to dissociate the strands
- to break the hydrogen bonds.

Heating had to be mentioned, and the effect it had on the process.

Question 2c.

Marks	0	1	2	Average
%	62	22	16	**0.6**



On the diagram or in the space below the question, students needed to show primers anneal, one per strand, at opposite ends (for the first mark), and show one of:

- primers attach at 3' end
- temperature reduced to approximately 50°C
- DNA/Taq polymerase is added
- propagation occurs away from the primer.

Question 2d.

Marks	0	1	Average
%	30	70	**0.7**

The arrow needed to point towards the top of the page.

Students were required to know that DNA has a negative charge and hence would move towards the positive electrode.

Question 2e.

Marks	0	1	2	Average
%	46	23	31	**0.9**

Both of:

- the standard consists of fragments of known length
- they are used to estimate the size of the samples.

To gain the two marks, a link had to be established between the comparison of known to unknown. Too often students made vague statements such as 'The standard is used to compare to the sample'.

Question 2f.

Marks	0	1	Average
%	61	39	**0.4**

A suitable conclusion could be:

- the sample is not from the victim
- the sample could be from either suspect.

To gain the mark here students had to make a valid conclusion rather than a simple observation such as 'The sample matched the suspects'. Some incorrect conclusions included 'both suspects must be guilty', 'both suspects are identical twins' or even 'the victim wasn't at the crime scene'.

Question 2g.

Marks	0	1	Average
%	63	37	**0.4**

Any one of:

- apply the same process to a different gene locus
- use another suitable DNA technique, such as DNA sequencing
- use another forensic method, such as blood analysis or fingerprinting.

To gain the mark, a forensic, logical and feasible action had to be recommended. Incorrect suggestions included 'check alibis' and 'interview the victim'.

Question 3

Question 3a.

Marks	0	1	Average
%	72	28	**0.3**

Either of:

- genes are only activated/transcribed when required
- required genes are expressed, which can save energy.

To gain the mark the purpose of gene regulation was required. A common answer that lacked sufficient information was 'genes are turned on and off'.

Question 3b.

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

The transcription of all genes is stopped or suppressed.

Question 3c.

Marks	0	1	Average
%	83	17	**0.2**

Either of:

- enzyme 1 is inhibited
- compound 1 is not produced.

Question 3d.

Marks	0	1	2	Average
%	74	13	13	**0.4**

Both of:

- when tryptophan is available, its presence prevents further tryptophan being produced
- therefore the cell does not waste energy or resources producing tryptophan.

In parts b., c. and d. students were not awarded the mark if they stated that the gene/enzyme was repressed, as the stem of the question stated that tryptophan acts as a repressor. However, students could gain the mark if they indicated in their response that they understood the term; for example, for part c. 'tryptophan represses enzyme 1 and stops production of compound 1'.

It was evident that many students did not understand the term repressor. They found it difficult to **apply** their knowledge to this question, which was essentially a feedback system.

Questions 4

Question 4a.

Marks	0	1	Average
%	28	72	**0.7**

In generation II, the male (father) is affected and the trait is passed to generation III, where all daughters are affected

This part was well answered; however, quite often students included too much unnecessary information. Although this was not detrimental, more concise answers should be developed. Some students incorrectly used the term 'infected' rather than 'affected'; they were not penalised in this instance. It was pleasing to see the number of students who used the pedigree numbers to explain their answer.

Question 4b.

Marks	0	1	2	3	4	Average
%	19	22	18	19	22	**2.1**

	i. Phenotype	ii. Possible genotype(s)
rabbit I-1	Impossible to tell	X^dX^D, X^dX^d
rabbit I-2	Does not have the disease	X^dY
rabbit I-3	Has the disease	X^dX^D, X^DX^D
rabbit I-4	Impossible to tell	X^DY, X^dY

The question required that students use the symbols given. Students should also use the selection of descriptions provided for clarity; however, this was not penalised. Some students wrote the information for genotype and phenotype in the wrong column; greater care should have been exercised here. Rabbit I-1 was incorrectly answered by many students

Question 4c.

Marks	0	1	2	Average
%	51	26	23	**0.8**

Genotypic ratio: 1 X^dX^D: 1 X^DY : 1 X^dX^d : 1 X^dY

Phenotypic ratio: 1 affected female: 1 affected male: 1 normal female: 1 normal male

Many students failed to state the gender of the rabbits when giving the phenotype. In sex-linked inheritance, the gender of the offspring is known and should therefore be included in any answer given.

Question 5
Question 5a.

Marks	0	1	Average
%	35	65	**0.7**

The effect of the diet on the size of the jaw.

Question 5b.

Marks	0	1	Average
%	62	38	**0.4**

The size of the prey given.

'The type of prey' was deemed too vague, as other types of prey were listed in the stem of the question.

Question 5c.

Marks	0	1	2	Average
%	31	32	37	**1.1**

5ci.
Mainland snakes (groups C and D) had normal jaw length at maturity.

5cii.
Island snakes' (groups A and B) jaw length increased in size when large prey was eaten.

Question 5d.

Marks	0	1	2	3	Average
%	33	19	22	27	**1.5**

Students needed to make the following points in their responses:

- the island and mainland snakes were geographically isolated **or** no gene flow
- each population experienced different selection pressures
- populations, if reintroduced, were unable to produce viable fertile offspring.

This question was well answered and many students set out their answers in a clear and concise way. They also related the information to the snakes and a few students included diagrams to assist their explanation (although a diagram was not required to achieve full marks). Incorrect terms that were used included 'geologically separated' and 'environmental pressure'. It is important to note that not all environmental pressures act as selective pressures.

Question 6
Question 6a.

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

A trait determined by two or more genes.

Some students incorrectly stated many alleles.

Question 6b.

Marks	0	1	Average
%	49	51	**0.5**

Larger seeds have proportionally more protein.

Many students incorrectly answered this part in terms of the plant's qualities, such as drought tolerance.

Questions 6c.

Marks	0	1	2	Average
%	64	20	15	**0.5**

Students needed to make both of the following points in their responses:

- the farmer would choose the largest seeds from a crop and plant them

- these plants would then reproduce and the process would be repeated for many generations.

The question specifically asked how a farmer could develop a large-seeded variety. Many students did not recognise this as a question on selective breeding. The method described had to be possible for a farmer to undertake, hence genetic engineering was not accepted. Many students suggested cross breeding different species, even though they had correctly answered Question 5c. It is important to note that scientific methods and processes apply to everyday life and are not just confined to laboratories.

Question 7
Question 7a.

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

Stratigraphy could be used, where the relative age of a fossil can be determined by the position of that stratum.

This question was very poorly answered as many students did not understand the term 'relative dating' and described absolute dating, using an element with a known half life.

Question 7b.

Marks	0	1	Average
%	41	59	**0.6**

Convergent evolution

Some students incorrectly used the term 'co-evolution' and a number of sudents used the term 'parallel evolution'.

Question 7c.

Marks	0	1	2	Average
%	12	19	70	**1.6**

Method	Evidence
• killed and ate fresh meat • hunted	• killing teeth • slicing teeth • no grinding teeth for crunching old bones
Ambush rather than pursuit	Short strong limbs – suited for grappling, not running fast or climbing
Grappled and killed prey	• opposable thumbs for holding • claws for killing or climbing
Killed by biting (jugular, spine of prey)	• long front teeth • powerful jaws

This part was very well answered and students could easily identify the method of feeding and relate it to the evidence given.

Questions 8
Question 8a.

Marks	0	1	Average
%	42	58	**0.6**

Inability to synthesise Vitamin C so it must be obtained from the diet.

Question 8b.

Marks	0	1	Average
%	41	59	**0.6**

Smell is most important to dogs and mice and least important to apes and humans.

Students were required to use the names of the specific examples given rather than making general statements.

Question 8c.

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

Students needed to make both of the following points:

- apes and monkeys are less dependent on smell or more dependent on vision
- they would therefore have more pseudogenes or less smell genes.

This question was poorly answered as many students did not make the link that, as smell is less important to these animals, mutations are possible in genes responsible for smell as these will not affect the organism's chance of survival. These mutated genes are classed as pseudogenes.

Students who gained both marks clearly explained the outcome for both types of genes. Many students used the pronoun 'they' and it was not possible to interpret which gene was being discussed.

Question 8d.

Marks	0	1	2	Average
%	76	16	8	**0.3**

Students needed to make both of the following points:

- pseudogenes are not expressed and any mutation in them does not harm the offspring when passed on
- functional genes become inoperative or produce a different protein which could affect the survival of offspring.

Question 9
Question 9a.

Marks	0	1	2	Average
%	55	23	22	**0.7**

Students needed to make both of the following points:

- DNA hybridisation involves the dissociation of different samples of DNA and their reassociation, providing a measure of similarity
- the greater the similarity of the DNA (determined by melting temperature), the more closely related the two organisms are from which the samples were taken.

Many students demonstrated a sound understanding of the process of DNA hybridisation, which was pleasing. The inference of close relationship due to the degree of hybridisation was not clearly made by many.

Question 9b.

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

Any one of:

- artefacts associated with the production of clothing, such as bone needles
- fossilised remains of clothing
- cave paintings showing humans wearing clothes.

Common incorrect answers involved the presence of fossilised lice or of preserved humans showing less hair.

Question 9c.

Marks	0	1	Average
%	37	63	**0.7**

Living in clothing provided the lice with:

- a warm environment
- close contact to the whole body
- more places to hide
- an easier way to transfer between hosts.

A common error was that many students stated that the lice ate the clothes, whereas the stem stated 'the lice live in the clothing but feed on the body'.