VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2005 Biology GA 3: Written examination

GENERAL COMMENTS

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.

The quality of the responses provided by some students was excellent; however, questions that required explanations or analysis still caused difficulty for most students. Often it was evident that students had not carefully read the question or referred to the information provided when answering questions. The marks for each question were a guide to the amount of information required in a response.

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	97	1	1	1	
2	63	8	16	13	
3	1	10	16	73	
4	12	6	5	77	
5	77	6	13	4	
6	18	2	74	6	
7	67	10	8	15	
8	5	16	9	70	
9	8	12	13	66	
10	28	47	22	2	Both responses A and B are the correct format for linked genes of a heterozygote. However, a parent of genotype represented by A would result in most offspring having the same phenotype as the parents, which is not shown in the data, so B is correct.
11	2	41	35	22	The stem of the question states that there is only one gene involved and three alleles (multiple alleles) – this produces four distinct phenotypes and hence discontinuous variation.
12	3	17	73	7	
13	31	13	41	15	Each chromatid consists of one molecule of DNA, hence four molecules are represented by the diagram.
14	10	64	19	7	
15	4	79	2	14	
16	9	6	79	6	
17	1	93	4	1	
18	52	2	33	12	
19	16	10	9	65	
20	10	11	66	13	
21	36	6	53	4	In warmer climates, the cyanogenic phenotype occurs more frequently and the non-cyanogenic phenotype is less frequent. Therefore ‘C’ cannot be correct. Non-cyanogenic clover plants are more likely to be eaten by slugs and snails, reducing their numbers.
22	95	1	1	2	
23	1	5	80	14	
24	10	73	5	12	
25	2	4	86	8	

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 the end of each question.

Question 1a.

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

53

Question 1b.

Marks	0	1	Average
%	18	82	**0.9**

Meiosis

The word had to be recognisable and unambiguous.

Question 1c.

Marks	0	1	2	3	Average
%	50	18	19	13	**1.0**

Students were expected to be able to accurately show the following:

- separation of homologues in meiosis I (at the end of the first divisions, showing one chromosome in each cell as double-stranded)
- separation of chromatids in meiosis II (at the end of the second division, showing chromosomes in four cells (two of each type) as single-stranded)
- the process of division involving cytokinesis, the spindle, etc.

Details of crossing over were not required to achieve full marks, but those students who did show crossing over were generally correct.

Question 1d.

Marks	0	1	Average
%	85	16	**0.2**

Chromosomes are not homologous and therefore will not pair during meiosis.

Many students stated that the Zenkey had an odd number of chromosomes, but failed to make the link to the behaviour of homologous chromosomes during meiosis. To state that gametes with an odd number of chromosomes cannot exist creates problems when human gametes contain 23 chromosomes.

Question 2a.

Marks	0	1	Average
%	32	68	**0.7**

A gene locus is the position of a gene on a chromosome.

Question 2b.

Marks	0	1	Average
%	71	29	**0.3**

At the molecular level the sequence of bases/nucleotides in the DNA will be different.

In both parts a. and b., answers were often imprecise and could not be awarded any marks.

Question 2c.

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

Mutation

Question 2d.

Marks	0	1	2	3	Average
%	27	8	20	45	**1.9**

Parent's phenotype	yellow	X	yellow
Parent's genotype(s)	$p^Y p^b$	X	$p^Y p^b$
Offspring phenotype	yellow		black
Offspring genotype(s)	$p^Y p^Y$ $p^Y p^b$		$p^b p^b$

Students were given one mark for the parents' genotype(s) and two marks for the offspring genotype(s) (one for yellow genotypes and one for black genotype). This part was well answered; however, students needed to use the allelic symbols given in the question in order to gain full marks.

Question 2e.

Marks	0	1	Average
%	34	66	**0.7**

Homozygous (recessive) or purebreeding

Many students incorrectly used the word homologous to describe the genotype.

Question 3a.

Marks	0	1	2	Average
%	53	25	22	**0.7**

ai.
The locus cannot be X-linked recessive because the father (II-2) of III-1 is unaffected.
aii.
The locus cannot be X-linked dominant because an affected father (I-1) has an unaffected daughter (II-1).

As stated in the question, specific reference had to be made to the pedigree and students had to elaborate; for example, 'X-linked recessive' not just 'recessive'.

Question 3b.

Marks	0	1	Average
%	64	36	**0.4**

There is enough information to identify autosomal recessive, because individual III-1 is a white tiger (affected) and has parents with normal pigmentation (unaffected).

Answers that stated that the condition skipped a generation were not awarded marks, as specific reference to the pedigree was required.

Question 3c.

Marks	0	1	Average
%	76	24	**0.3**

Inbreeding leads to a reduction in the number of phenotypes/reduction in diversity/reduction in variation, and populations with less variation are at risk if selective pressures change.

Many students confused the terms inbreeding and interbreeding; this could have been due to misreading or misunderstanding of the concept of inbreeding. Some students incorrectly stated that inbreeding causes mutations.

Question 4a.

Marks	0	1	2	Average
%	28	49	23	**1.0**

ai.
At 37°C the phenotype is wild type (dark green) and at 20°C it is virescent (pale green).

aii.
Any of:

- virescence is the recessive phenotype because it appears in the offspring of a cross of two wild type parents
- wild type is dominant
- both parents are heterozygous.

Question 4b.

Marks	0	1	2	3	Average
%	51	21	15	14	**0.9**

Accepted answers included:

- the crosses in the experiment are performed at 20°C
- testcross each parent; that is, cross each parent to the homozygous recessive (virescent)
- outcome: expect equal numbers of wild type (WT) (dark green) and virescent (pale green) in the offspring

or

- the crosses in the experiment are performed at 20°C
- interbreed parents from cross 3 with those of cross 4 (four crosses)
- outcome: always get three wild type one virescent in the offspring

One mark was given for each correct point.

It was important for students to recognise that a temperature of 20°C was required for the virescent phenotype to be expressed. It was also important to state the predicted results. Too often students made vague comments that could not be awarded any marks. It is worth noting that some students answered this question very well and set out a well-reasoned and logical answer. Answers involving gel electrophoresis were not awarded marks, as this alone could not prove the genotype of the parents.

Question 5a.

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

Tubes 1 and 2 are the control group to which other tubes can be compared.

Parts a. was generally well answered by students.

Question 5b.

Marks	0	1	2	Average
%	59	26	14	**0.6**

The conclusions which can be drawn are:

- the abnormal fungus cannot produce histidine
- the abnormal fungus can produce the other 19 amino acids.

Question 5c.

Marks	0	1	2	3	Average
%	47	27	8	18	**1.0**

ci.
The sequence codings for 'his' in RNA are CAU and CAC, which are GTA and GTG respectively in DNA.
5cii.
sequence 3
5ciii.
This sequence does not have the DNA triplet for histidine (GTA or GTG) whereas sequences 1 and 2 do, so the polypeptide could be made without interruption.

Many students gave the code for RNA in part ci.

Question 5d.

Marks	0	1	Average
%	77	23	**0.3**

Watson and Crick would have concluded that Adenine pairs with Guanine and Thymine pairs with Cytosine because these pairs are in approximately equal numbers.

To gain the mark, specific reference had to be made to the pairing of the bases.

Question 6a.

Marks	0	1	2	3	Average
%	62	9	14	15	**0.8**

The following points needed to be made:

- the antibiotic X killed off the majority of bacteria but some of the population was resistant to the antibiotic and survived
- after treatment was finished these resistant bacteria multiplied
- since resistance is genetic (inherited), the resistant bacteria passed on their resistance to subsequent generations (and the symptoms returned).

Many students failed to recognise that this was essentially a straightforward question on natural selection.

Question 6b.

Marks	0	1	Average
%	31	69	**0.7**

Some examples of an important reason for extensive testing are:

- to ensure the release of the transgenic bacteria was safe (protect the health of humans/other animals/plants)
- to ensure the bacteria would not harm other environments
- to make sure that bacteria can grow and function in the environment.

Question 6c.

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

An economic advantage had to be given, such as:

- reduces the time and money spent cleaning up non-degradable plastic material
- reduces the money spent on recycling non-degradable plastic material.

Many students gave non-economic reasons such as the harm to the environment caused by plastic. These were not awarded a mark.

Question 7a.

Marks	0	1	Average
%	36	64	**0.7**

Population X has selection against the homozygous recessive phenotype, as the frequency of the b allele is decreasing over time.

Question 7b.

Marks	0	1	Average
%	44	56	**0.6**

Any of:

- the allele b has become fixed
- the frequency of allele b = 1
- only one allele in population Y.

Some students misread the graphs for parts a. and b.Students should be encouraged to take greater care when reading the axes and applying this knowledge to the question asked.

Question 7c.

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

In population X there is selection against bb, but there are b alleles still present in the heterozygotes that survive and will pass on these alleles to the next generation.

This question was not well done. Many students did not realise that the b allele would be present in heterozygotes and would therefore persist in the population.

Question 8a.

Marks	0	1	2	3	Average
%	47	12	20	20	**1.1**

The following points needed to be made:

- two populations become separated/isolated from each other
- there is selection for different characteristics (for example, behavioural, physiological, morphological, etc.) in the two populations. The different selective pressures in the two environments result in the two groups becoming distinct from each other
- over time, individuals from the two populations become so different that they are no longer able to interbreed to produce fertile offspring.

One mark was given for each point. Students who answered this question well tended to clearly set out the main steps of speciation and provided the means to assess that speciation had occurred.

Question 8b.

Marks	0	1	2	Average
%	33	46	21	**0.9**

Any two of:

- thick eyebrow ridges
- sloping forehead
- no chin.

All the information required to answer this question was supplied. Too often, features that were not given in the stimulus material or features that were incorrect (such as having a small brain) were used by students.

Question 8c.

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

Radioactive carbon dating or radio isotopic dating.

Common incorrect answers included using the relative position of fossils, stratigraphy, or using a radioactive isotope with a very long half life, such as Potassium.

Question 8d.

Marks	0	1	Average
%	34	66	**0.7**

Examples of cultural evolution in a human population are:

- wearing clothes
- art
- burying the dead.

This question was generally well answered. Responses that could also apply to animals (for example, hunting in groups, living in caves, communicating with others) were not awarded the mark; however, the use of language was accepted.

Question 9a.

Marks	0	1	Average
%	14	86	**0.9**

Any one of:

- better able to detect and avoid predators
- better able to locate food (other animals)

- better able to hear the calls of a mate
- better able to hear their offspring (if they wander away).

Question 9b.

Marks	0	1	Average
%	34	66	**0.7**

Divergent evolution

Adaptive radiation or speciation were not awarded the mark, as these terms do not fit the data given.

Question 9c.

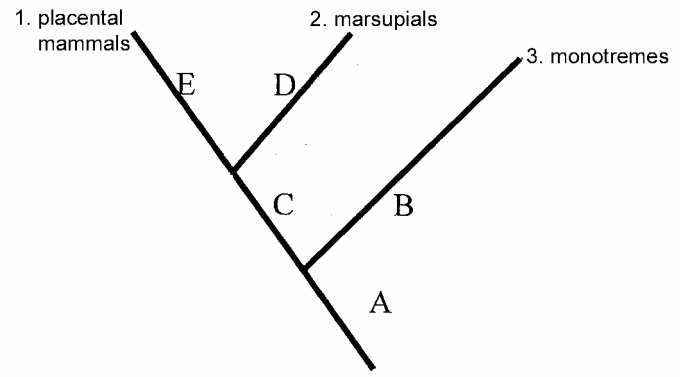
Marks	0	1	Average
%	40	60	**0.6**

Convergent evolution or parallel evolution

Question 9d.

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

- 1 and 2: placental mammals or marsupials
- 3: monotremes



Marks were not awarded if the word mammals was used instead of placental mammals (all three groups are mammals).

Question 9e.

Marks	0	1	2	Average
%	48	34	18	**0.7**

Branch B (evolution in monotremes), and either C (for evolution in placental mammals and marsupials) **or** E and D (for evolution in placental mammals and marsupials).

One mark was given for each point. There was confusion in this question, as many students, for example, correctly identified that evolution in placental mammals and monotremes occurred in C, but then incorrectly stated that it would again occur in E and D.