VICTORIAN CURRICULUM AND ASSESSMENT AUTHORITY

2005 Biology GA 1: Written examination 1

GENERAL COMMENTS

The examination paper showed that many students recalled knowledge and used scientific terminology appropriately. Some students gave excellent responses to the questions, and the majority of the students were able to apply their understanding to familiar contexts. Those students who could express themselves clearly were more likely to be awarded full marks.

Questions requiring an explanation always provide a greater challenge for students. Students must realise that their responses must address the questions asked. Marks are not awarded if a student merely restates information provided in the stem of the question; however, this information should be used to help formulate an answer to the question. The space provided for the answer gives an indication of the detail that is required in the response. Students who write much longer answers than required often waste valuable time. Students are also reminded to use the number of marks awarded for the question as an indication of the detail required in the answer.

The questions that required students to make a conclusion after being given experimental results proved difficult for the majority of the students. Making conclusions from experimental data is not the same as summarising the results of an experiment. Students should read through the practical activities that they completed during the year and look at the way conclusions can be drawn from experimental data.

Students need to be reminded that the standard of their handwriting may influence their results. If an assessor cannot read an answer, the response cannot be awarded marks. Responses to questions in Section B of the paper should be written in pen, not pencil.

Section A – Multiple-choice questions

In the table below, comments have been made about questions for which less than 60% of the students selected the correct response.

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

Question	% A	% B	% C	% D	% No Answer	Comments
1	1	78	1	19	0	
2	9	3	81	7	0	
3	7	11	19	62	1	
4	7	8	65	20	0	
5	21	14	58	7	0	Prokaryotic cells do not have membrane-bound organelles. Ribosomes (option C), which are composed of protein and ribonucleic acid, are not enclosed by a membrane and are found in prokaryotic cells. All other organelles listed have membranes.
6	66	10	14	10	1	
7	2	8	77	12	0	
8	2	17	6	75	0	
9	61	14	13	11	1	
10	1	11	86	2	0	
11	1	69	6	24	0	
12	8	7	22	63	0	
13	12	4	5	79	0	
14	46	35	6	13	1	The variable in this case is the concentration of solutes in the body. This change in concentration is detected by cells within the hypothalamus, making option A correct. If the variable was too high, responses 2 would be involved and there would be an increase in water reabsorption from nephron tubules, which makes options B and D incorrect. Effectors do not include cells within the digestive system, therefore option C is also incorrect.

Question	% A	% B	% C	% D	% No Answer	Comments
15	47	32	12	8	1	In any homeostatic mechanism, the variable (option A) is kept relatively constant. The input to sensors and effectors and the outputs from effectors will all change according to the level of the variable.
16	6	75	9	9	0	
17	5	2	5	88	0	
18	4	76	15	5	0	
19	13	61	11	14	0	
20	36	22	30	11	1	Bubbling carbon dioxide into the pond water would slow down the metabolic rate of the *Ameoba proteus* and increase the time taken for it to reproduce, which makes option A the correct response. If the density of the amoebae was doubled, there would be competition for the food supply and the rate of reproduction would be slower, so option B is incorrect. Option C is incorrect, as metabolic reactions are temperature dependent – if the temperature was reduced the rate of metabolism would also reduce and the amoebae would take longer to reproduce. Option D is also incorrect: the amoebae are not photosynthetic and any change in light intensity would have no effect on the rate of reproduction.
21	8	60	16	16	0	
22	65	9	14	12	1	
23	6	84	6	3	0	
24	2	10	86	2	0	
25	12	77	6	5	0	

Section B – Short-answer questions

For each question a correct answer (or answers) is provided. In some cases, the answer provided is not the only answer that could have been awarded marks.

Question 1

Marks	0	1	2	3	Average
%	3	9	26	61	**2.5**

Cellular structure in the plant cell	Matching function choose one from (A–H)
Golgi apparatus	D
mitochondria	A
chloroplast	F
lysosome	B
vacuole	H
cell membrane	E

Question 2

2a

Marks	0	1	2	Average
%	44	13	43	**1.0**

2ai.

Ribosomes

2aii.

The function of the ribosomes is to synthesise protein.

Students needed to recognise the pathogen as a bacterium. The presence of a circular molecule of DNA and the size of the pathogen should have been used to identify the pathogen.

2b

Marks	0	1	2	Average
%	33	50	17	**0.9**

2bi.
A virus

2bii.
The pathogenic agent's inability to reproduce outside a living cell.

Many students correctly identified the pathogenic agent as a virus but fewer students could give a significant feature that distinguishes a pathogenic agent from a pathogenic organism. Incorrect responses that gave 'smaller size' or 'becoming living within a cell' as the significant feature were not awarded a mark.

2c

Marks	0	1	Average
%	23	77	**0.8**

The mosquito is a vector, which transmits the organism from one human to another.

Some students' responses stated that the mosquito was a carrier. When there was no further explanation as to what the student meant by a carrier, the response was not awarded a mark.

2d

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

The following answers were accepted:

- an external covering that is resistant to digestion by mosquito digestive enzymes
- an external covering that is resistant to extremes of pH that may be encountered
- mouth parts to burrow through the stomach wall of the mosquito.

The structural feature chosen had to clearly relate to the survival of the larvae in the mosquito. If a structure was given and it was not clear how this structure could help in the survival of the larvae the response was not awarded a mark. An example of such a response would be 'an external covering' with no further explanation.

2e

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

The following responses were accepted:

- suckers or hooks that enable them to secure their position in the lymph nodes
- high surface area to volume ratio to maximise the absorption of nutrients.

This time the structural feature had to relate to the survival of the larvae in the human. Some students incorrectly thought that the larvae passed through the digestive system of the humans. Students are reminded to read the information in the stem of the question carefully and use this information when formulating their answers.

2f

Marks	0	1	Average
%	22	78	**0.8**

There were many correct responses that could have been given to this question, some of which were:

- vaccinate humans against both larval and adult proteins
- for humans, use a chemical treatment that is active against the larva and worm
- clean up mosquito breeding areas
- using a spray to kill mosquitoes
- some form of human behaviour that reduces the chance of being bitten.

Question 3

3a

Marks	0	1	2	Average
%	47	23	29	**0.8**

3ai.

Oxygen

3aii.

Either of following responses was accepted:

- the two hydrogens are removed from water and used to form $NADPH^+$, leaving the oxygen as an output product
- the breakdown of water into hydrogen and oxygen.

Many students had an understanding of the process of photosynthesis but fewer had a clear understanding of the two distinct phases that occur in photosynthesis.

3b

Marks	0	1	Average
%	56	44	**0.4**

A carbohydrate, **or** glucose **or** sugars.

Incorrect responses that were not awarded a mark included 'sucrose' and 'starch'.

3c

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

Either of the following answers was accepted:

- oxygen is required for aerobic respiration. Oxygen in the atmosphere is generated as an output of photosynthesis
- glucose produced in photosynthesis is the substrate for cellular respiration.

Students had to relate aerobic respiration and photosynthesis. Stating that one was the reverse process of the other was not sufficient to be awarded a mark.

3d

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

Aerobic respiration has a much greater yield of adenosine triphosphate (ATP) per molecule of carbohydrate than anaerobic respiration. For example, a net gain of 36 or 38 ATP compared with 2 ATP.

Year 12 Biology students should have a good understanding of the process of aerobic and anaerobic respiration. It was not sufficient to state that aerobic respiration produces more ATP if no indication was given as to how much more. An example of a typical response that was not awarded a mark was 'aerobic respiration produces more ATP molecules than anaerobic respiration'.

3e

Marks	0	1	2	3	Average
%	44	30	19	7	**0.9**

Conclusions and explanations

- The presence of the apical meristem inhibits the growth of lateral buds **because** when the apical meristem was removed the lateral buds grew, as evident from comparing group 1 with group 2.
- Auxin or its equivalent is produced in the apical meristem and inhibits the growth of lateral buds **because** when auxin was applied to the cut apical meristem no lateral buds grew, as evident from comparing group 2 with group 3.
- Auxin diffuses from the tip of the apical meristem **because** when a barrier stopped its flow lateral buds grew, as evident from comparing group 1 with group 4.

Students need to be able to make a conclusion from a set of experiments. Many students thought that restating or summarising the data was the same as making a conclusion. The conclusions made had to relate to the growth of the lateral buds; however, many students referred to apical dominance instead of lateral bud growth. The overall performance by students on this question was poor, which highlights the need for students to practise the skill of making conclusions after being given experimental data.

Question 4

4a

Marks	0	1	Average
%	77	23	**0.2**

Either of:

- the dry weight gives an indication of plant growth – biomass
- water content is variable (that is, each plant could have different amounts of water) and is not an indicator of growth.

The aim of the experiment was to determine the effect of a plant parasite on plant growth. Therefore, when the plants were measured the measurement had to reflect plant growth. That is why dry weight is used.

4b

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

Any of:

- nutrients
- glucose
- an energy source.

4c

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

The parasites appear to reduce/slow down plant growth.

Some students incorrectly suggested that the plants lose weight due to the presence of the parasite. The parasite is slowing plant growth as it uses the nutrients that would normally be available for the plant. This is not the same as the plant losing weight. Some students indicated that the parasites affected plant growth but did not explain whether they increased or decreased growth. These students could not be awarded a mark. Students needed to keep in mind the aim of the experiment and then make a relevant conclusion.

Question 5

5a

Marks	0	1	2	Average
%	47	33	19	**0.8**

Conclusion 1 and evidence

Either of:

- a four-week-old mouse that receives a graft of tissue of a kind it has never encountered before identifies it as a foreign body and makes antibodies against it **because** the mouse rejects the graft several weeks after receiving it
- by the time it is four weeks old, a mouse has a competent immune system that is able to respond to the presence of foreign materials **because** the mouse rejects the graft several weeks after receiving it.

Conclusion 2 and evidence

- The immune system of a newborn mouse accepts foreign material and remembers it as self **because** when, after four weeks, a graft is made of the same type tissue there is no rejection of the graft.

Generally students outlined the results of the experiment without making any conclusions and could not be awarded the marks. This question again highlights the need for students to be able to make valid conclusions when presented with the results of an experiment.

5b

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

The mouse was not exposed to strain C leucocytes as a newborn, so it would be expected that the skin graft from strain C would be rejected **because** the mouse would identify it as a foreign body and make antibodies against the tissue.

Some students predicted what would happen with strain B as well as strain C. Students are reminded to read the question and only respond to the question asked. This will save them time and guard against the possibility of making an incorrect statement.

5c

Marks	0	1	Average
%	68	32	**0.3**

Apoptosis is natural cell death. In the formation of a tumour, apoptosis is occurring at a slower rate than the reproduction of new cells, hence a tumour forms.

Most students could define apoptosis but could not apply this knowledge to the question. Many students incorrectly thought that a tumour was a mass of dead cells.

5d

Marks	0	1	2	Average
%	57	34	9	**0.6**

An outline of an experiment would be:

- take two groups of genetically identical mice
- inject dead cells from the tumour growth into members of group A
- give no treatment to the mice in group B
- some weeks later, inject the mice in both groups with living cells from the tumour
- examine the mice several weeks later. If the hypothesis is correct, group A mice should remain healthy and group B mice should develop the tumour.

The question stem gave students clues about what could be used in the experiment. The stem stated that some cells from the tumour were killed while others were kept alive for several weeks for later use. Both pieces of information should have been used by the students when formulating their answers.

Many answers included the following errors:

- only using one mouse in the experiment
- having no control mice
- not using the dead cells from the tumour
- not injecting mice that had been treated with living tumour cells some time later.

All students seemed to have knowledge of a controlled experiment but were not necessarily able to design a controlled experiment.

5e–f

Marks	0	1	2	Average
%	15	55	30	**1.2**

5e

Strain Q **or** strain N **or** strain P

Strain Q will result in the production of four different antibodies, strain P will result in the production of three different antibodies and strain N will produce two different antibodies.

If we consider strain N:

- one of the antibodies produced will be effective against strains M, N, P and Q
- the other antibody produced will be effective against strains N and R.

Therefore, if strain N is used then the vaccine will be effective against all strains of the *Staphylococcus* bacteria shown.

By working through in the same way for strains P or Q, the conclusion can be made that they can also be used to produce a vaccine that will be effective against all strains of the *Staphylococcus* bacteria shown.

5f
All five strains – M, N, P, Q and R

A common error made by students was to give four of the strains and leave out the strain they had chosen in their answer to part e.

5g

Marks	0	1	Average
%	57	43	**0.4**

Student X is correct. Although the antibody drawn by student Z would have some effect against strain P, the antibody drawn by student X would be twice as effective because there are twice as many antigens that student X's antibodies can act against.

The most common incorrect response was student Y. Some students seemed to have a limited understanding of the structure of an antibody. An antibody has two antigen binding sites and these two sites are identical within the one antibody. Student Y has drawn an antibody with two different shaped antigen binding sites; this is not an accurate drawing of an antibody and is therefore incorrect. The antibodies drawn by both students X and Z will attach to strain P, as the shape of the antigen binding sites fits onto at least one of the antigens displayed on the surface of strain P. However, student X has drawn the most effective antibody as there are two sites on strain P to which the antibody could attach.

Question 6
6a–b

Marks	0	1	2	Average
%	38	47	15	**0.8**

6a
Chemical M diffuses across the small gap between the end of the nerve axon from which it is secreted and makes contact with the target cell.

Students needed to identify that chemical M was a neurotransmitter. The way in which the neurotransmitter crosses the synaptic gap was not well understood by many students.

6b
Chemical N diffuses from the bloodstream into tissue fluid and makes contact with the target cell.

Students needed to identify chemical N as a hormone. This question was correctly answered by the majority of students.

6c

Marks	0	1	2	Average
%	9	51	41	**1.4**

6ci.
The nervous system

6cii.
Messages are carried in the form of electrical impulses from one nerve cell to another and they move much more rapidly than blood in the bloodstream.

Many students correctly identified the nervous system as the system with the quicker response; however, fewer students could describe a characteristic that made the response time quicker. Many made the mistake of simply restating what was given in the stem of the question and could not be awarded a mark.

6d

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

Hormones will only act on cells that have particular receptors for that hormone.

6e

Marks	0	1	Average
%	85	15	**0.2**

Either of:

- as a cell ages, receptor sites may degenerate and be less effective in identifying a particular hormone
- receptor sites on target tissues may degenerate with age and may be less effective in binding the particular hormone.

Parts d and e were not well answered by the majority of students. Many failed to recognise that a hormone acts on particular receptors on its target cells. These receptors are not found on other body cells and therefore the hormone will not influence these cells.

Question 7

7a

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

Any of:

- it reduces water loss from damaged tissues
- skin is a surface across which heat transfer is controlled
- it has an intact barrier between the external and internal environment that maintains the integrity of the body – prevents infection.

7b

Marks	0	1	Average
%	84	16	**0.2**

Any of:

- younger, more actively dividing cells will grow and spread over damaged areas more quickly than older cells in a sheet
- the body's own tissue fluid provides the most appropriate nutrients for growing cells
- it initially layers only one or two cells thick so each cell is more likely to be in contact with fluids and more able to absorb greater amounts of nutrients.

Many students stated that the skin would grow more quickly as it could use the body fluids. This was simply repeating information in the stem of the question and could not be awarded a mark.

7c

Marks	0	1	2	Average
%	49	29	22	**0.8**

Glucose is water soluble and so does not readily pass through lipid cell membranes. Hence, the process of facilitated diffusion makes glucose entry into cells possible through special channels with the aid of a carrier molecule.

Few students recognised that, being water soluble, the glucose molecule does not pass easily through cell membranes that are composed of lipids. Some students confused facilitated diffusion with active transport and stated that energy was required for the process of facilitated diffusion to take place.

7d

Marks	0	1	2	Average
%	34	32	35	**1.0**

7di.

The liver

Students needed to recognise that the hormone released by the pancreas was glucagon.

7dii.
The hormone facilitates conversion of stored glycogen into glucose. The glucose is released into the blood and blood glucose concentration increases.

Students must clearly be able to identify the hormone glucagon and its substrate glycogen. The hormone acts on cells in the liver and not muscle cells.

7e

Marks	0	1	Average
%	22	78	**0.8**

Form C has a longer duration of action than the other two forms, which means that a person may need fewer injections.

7f

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

When the glucose level in the blood is at a 'dangerous' level and must be reduced as quickly as possible.

The question asked students to describe a situation. Many of the incorrect responses merely restated what was in the table.

Question 8
8a

Marks	0	1	Average
%	21	79	**0.8**

Either of:

- the camel, because it will take longer to become dehydrated
- the camel, because it loses less water each day.

An answer that only stated 'the camel' could not be awarded a mark as the question asked for an explanation of which animal would survive the longest.

8b

Marks	0	1	2	Average
%	23	51	25	**1.0**

8bi.
Heat is required for evaporation and that heat is taken from the animal, which results in a reduction in body temperature.

The concept of how evaporative cooling cools an animal was poorly understood by many students. For sweat to evaporate from the skin it must be heated. The heat comes from the body of the animal. When the sweat evaporates it takes this heat away from the body and thus the animal is cooled.

8bii.
The mammal may lose water through urine or faeces or when breathing out.

8c

Marks	0	1	Average
%	95	5	**0.1**

Panting provides a continuous current of air over the moist surface and hence is more likely to increase the amount of evaporative cooling.

8d

Marks	0	1	Average
%	92	8	**0.1**

Physiological adaptations that may be found in these mammals include:

- extracting extra water from the faeces
- an ability to reabsorb increased amounts of water from potential urine (maybe extra antidiuretic hormone is produced to retain more water)
- the plasma volume is maintained at the expense of tissue fluid so circulation is not impaired
- an ability to function with some dehydration.

Many students described a structural (instead of physiological) adaptation. The most common incorrect response given was ‘the loop of Henle in the kidney would be longer so that the mammal would produce more concentrated urine’.