

## SPECIFIC INFORMATION

## Section A – Multiple-choice

This table indicates the approximate percentage of students choosing each distractor. The correct answer is the shaded alternative.

Question	A	B	C	D	Question	A	B	C	D
1	2	7	7	84	14	64	10	11	15
2	6	77	10	7	15	9	4	72	16
3	2	9	87	1	16	20	68	6	6
4	9	10	6	74	17	5	4	1	90
5	4	13	79	5	18	43	25	9	22
6	3	3	2	92	19	1	80	4	14
7	1	51	14	34	20	62	1	36	2
8	74	4	16	6	21	69	13	11	6
9	61	13	15	11	22	7	82	5	6
10	4	86	6	4	23	6	17	67	9
11	2	8	87	3	24	5	19	67	9
12	5	13	78	5	25	9	76	9	5
13	3	2	2	92					

## Question 7

The microorganisms are found living in springs of boiling water. The enzyme activity of these microorganisms is therefore most likely at an optimum when the temperature is at 100°C. 37°C is the optimal temperature for enzyme activity in humans.

## Question 18

Design 1 exposes the same 12 ducks to four different drinking waters during the course of the experiment. Design 2 exposes only three ducks to each different drinking water. There will be some variation between individual ducks which may influence the results obtained from an experiment set up along the lines of design 2.

## Section B – Short Answer

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

a.

Marks	0	1	2	3	Average
%	26	44	27	3	1.07

Cell Type	Structure/ Cell Characteristic	Function
Neuron	Thin processes extending from cell body	Transmission of nerve impulses
Microglia	flexible cell membrane capable of movement to engulf material outside the cell	Phagocytosis
Ependymal cells	Cilia on one surface	Movement of material or fluid over surface of the cell

Many students could correctly identify the function of the thin processes extending from the cell body as a neuron. Students may not have been familiar with ependymal cells or microglia but should have knowledge of phagocytotic cells and the function that cilia has on cells. Some students incorrectly stated that cilia increase the surface area for absorption of materials into a cell.

b.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	58	31	10	<b>0.51</b>

Beaker A (10% glucose at 30°C)

**Reason**

water moves along a concentration gradient from high concentration of water to a low concentration of water AND water therefore would move from inside the cell across the membrane to the 10% glucose solution (that is, either beaker A or B)

**AND**

Movement of molecules is greater at higher temperatures therefore there is a greater movement at 30°C than 1°C. Therefore the celery in beaker A would show greatest loss of mass.

Many students could correctly identify the piece of celery that would show the greatest loss in mass after 30 minutes. Most students could describe the movement of water along a concentration gradient but very few students could clearly reason why the increase in temperature increased the water loss. Some students incorrectly related the increase in temperature with enzyme activity. Students need to remember that osmosis is a passive process.

**Question 2**

a.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	31	69	<b>0.69</b>

The growth hormone (auxin) is produced in the tip of coleoptiles. Although group 2 coleoptiles were cut, the tip remained and auxin was available to diffuse down the stem and stimulate growth. In group 3, the removal of tips meant no auxin was available and hence no growth.

Students are reminded to carefully read the stem of the question. Some students referred to light receptors in their answers. The stem of the question states that the coleoptiles were incubated for four hours in darkness.

b.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	47	53	<b>0.53</b>

Coleoptile juices in agar contain a growth hormone (auxin) that diffuses from the agar into group 5 coleoptiles whereas the agar on group 6 coleoptiles contains no juices therefore no hormone to stimulate growth.

When a question requests a comparison be made between two groups the response should make mention of both groups.

Student responses such as 'group 5 coleoptiles have auxin' could not be awarded a mark as no mention of what happened to group 6 was made. Some students incorrectly referred to the presence of nutrients in the juice as the cause of the growth.

c.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	7	39	54	<b>1.46</b>

Predicted growth result	Experimental Group			
	7	8	9	10
No growth				✓
Vertical growth	✓			
Bending to left			✓	
Bending to right		✓		

The most common mistakes made by students when filling in this table were predicting the growth result for groups 8 and 9. Many incorrectly stated that group 8 would bend to the left and group 9 to the right.

### Question 3

a.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	47	53	<b>0.53</b>

They regrow but not back to their original length.

Reading data from a graph is an important skill. The stem of the question states 'from the data shown in the graph' and students should refer directly to the graph. Better students made reference to the actual length of the flagella in their responses. An example of a good response would be 'the flagella grow back to an average length of 9.5µm, about 1 µm smaller than their original length'.

b.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	66	34	<b>0.34</b>

Lens C. Flagella are just over 10 µm long. A field of view with 75 µm diameter would allow for greater magnification of the flagella which means much greater accuracy than having to measure 10 µm in a field of 450 or 1800 µm diameter.

Many students did not know that a smaller field of view equated to a higher magnification of the flagella. The higher magnification made it easier to measure the flagella that were only 10 µm long. Another lens would have been used if the flagella had been longer than 75 µm as the flagella would not fit into one field of view.

c.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	51	49	<b>0.49</b>

A cell wall of a typical plant cell is made of cellulose, not glycoprotein.

d.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	18	32	51	<b>1.32</b>

- i. Golgi complex **OR** Golgi body **OR** Golgi apparatus
- ii. Organelles that package and store material into vesicles for export from the cell.

e.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	44	56	<b>0.56</b>

Oxygen.

f.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	28	72	<b>0.72</b>

Adenosine triphosphate or ATP.

g.

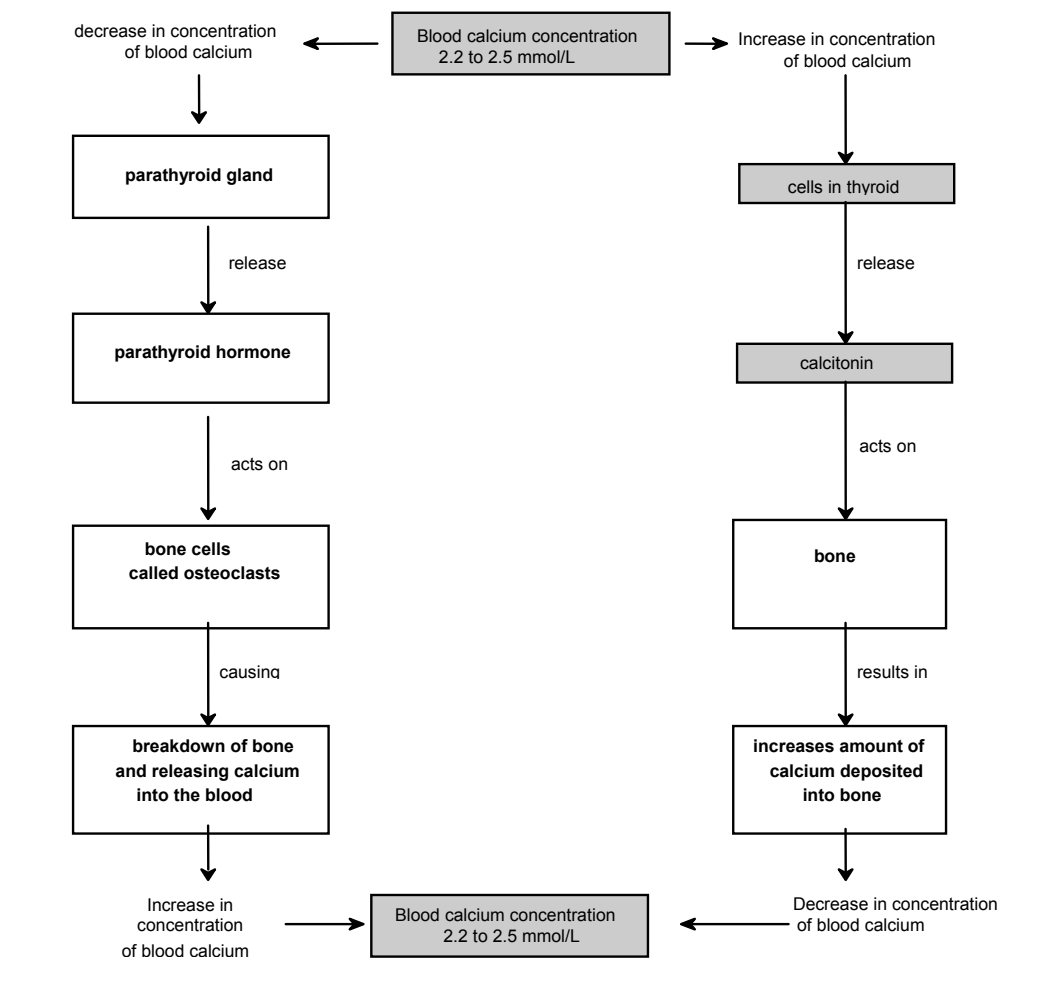
<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	59	14	27	<b>0.68</b>

- i. Presence or absence of oxygen.
- ii. When oxygen is present, the amount of ATP produced per molecule of glucose is about eighteen times the amount produced when there is no oxygen.  
**OR**  
When oxygen is present, there is 36 ATP (or 38 ATP) produced per molecule of glucose compared with only 2ATP in the absence of oxygen.

**Question 4**

**a**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Average</b>
<b>%</b>	11	4	29	56	<b>2.29</b>



Students should be familiar with flowcharts illustrating feedback mechanisms. Although students may not be familiar with the mechanisms controlling human blood calcium concentrations all relevant information was included in the paragraphs preceding the question and could be used to fill in the empty boxes in the flowchart given in the question.

**b.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	66	34	<b>0.34</b>

Receptors or chemoreceptors.

**c.**

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	51	35	15	<b>0.64</b>

Control mechanism in homeostasis in which the state of a variable is monitored to see if it changes and if a change is detected, a response is triggered to reverse the direction of the change.

**OR**

Control mechanism in homeostasis in which a change in a stimulus is detected and a response is triggered that decreases the stimulus.

Few students could clearly express this concept. The question was worth two marks and students needed to make two distinct points to be awarded full marks.

### Question 5

a.

Marks	0	1	Average
%	66	34	<b>0.34</b>

Oxygen is used in cellular respiration to produce ATP which drives metabolic reactions in cells.

Many students wrote 'the greater the intake of oxygen the higher the metabolic rate'. This response was not awarded a mark as it does not explain how oxygen is used to drive the metabolic rate of the animals.

b.

Marks	0	1	Average
%	32	68	<b>0.68</b>

From 15°C to 25°C

Students were expected to state correct units in their answer. Answers of 15 to 25 were not awarded a mark. The unit for temperature is given on the horizontal axis of the graph and students should be able to copy the unit exactly as it is written on the graph.

c.

Marks	0	1	2	3	Average
%	20	21	28	31	<b>1.69</b>

- i Curling up reduces the surface area exposed and therefore reduces the area from which heat may be lost **OR** A lower surface area to volume ratio means less heat per unit volume is lost by the animal.
- ii The continued contraction of muscles during shivering generates heat for the animal **OR** the metabolic activity involved in the muscle contraction of shivering generates heat for the animal.
- iii Dilation of blood vessels allows a greater volume of blood to flow close to the surface and a greater surface area across which heat can be lost. The spreading of saliva allows surface heat of the animal to be used in evaporation of the saliva. Both observations relate to increased loss of heat from the animal.

d.

Marks	0	1	Average
%	65	35	<b>0.35</b>

Water produced by metabolic activities in the animals' tissues.

Incorrect responses given by students related to the environment that the springhare is naturally found, for example 'obtaining water from leaves of plants'. Students are reminded to read the information given in a question and take it into account when formulating their answers.

e.

Marks	0	1	Average
%	55	45	<b>0.45</b>

Lower temperature means a lower metabolic rate and hence less heat produced by metabolic activities. Therefore less requirement for water loss to control body temperature

**OR**

Air more humid inside the burrow so reduced evaporation of water from surface of the springhare. Therefore less water loss

**OR**

During the hotter part of the day the temperature in the burrow is lower than the outside temperature and there will be a lower evaporation rate of water from exposed surfaces. Therefore less requirement for water loss to control body temperature.

### Question 6

a.

Marks	0	1	2	Average
%	14	49	37	1.23

i Insulin.

ii Insulin acts on cells so that the cells increase their uptake of glucose from the blood.

**OR**

Insulin acts on cell membranes so that the cells increase their uptake of glucose from the blood and stimulates liver cells to convert glucose into glycogen.

Many students correctly identified the hormone as insulin. Responses such as 'insulin reduces blood sugar levels' without any further explanation were not awarded marks.

b.

Marks	0	1	Average
%	31	69	0.69

An increase in the concentration of glucose in the blood.

c.

Marks	0	1	2	Average
%	43	40	18	0.75

Two points were required in the answer to this question.

- The pump would be able to deliver the insulin at frequent intervals and so less hormone would be required at each delivery. With hormone injections, larger volumes of the hormone would be delivered at each injection.

**AND**

- Peaks and troughs of amount of hormone present would be greater with the injections, hence greater variation in blood glucose. The peaks of glucose would be higher with injections and the lows of glucose would be lower.

### Question 7

a.

Marks	0	1	Average
%	52	48	0.48

The dead or attenuated cells are still identified as foreign and retain antigenic property to stimulate the production of antibodies against it when injected.

b.

Marks	0	1	2	Average
%	63	24	13	0.49

Two points were required in the answer.

- After vaccination, the antigens combine with some of the B cells in the individual receiving the vaccination and cause the B cells to reproduce rapidly resulting in large numbers of cloned cells (that is clonal expansion).

**AND**

- Many of these cloned cells form plasma cells but some form B memory cells which can survive for many years, sometimes for life and react immediately to produce antibodies if the person is reinfected with the particular antigen.

The concept of clonal expansion was poorly understood by many students. Some students incorrectly stated that plasma cells give rise to memory cells.

c.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	37	63	

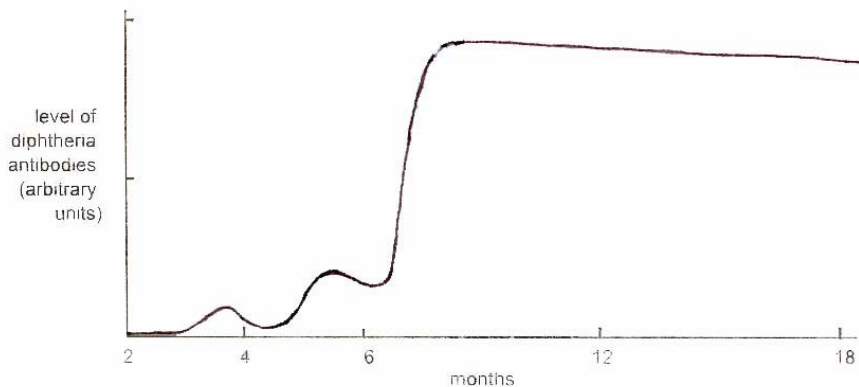
Antibodies in a newborn baby will have crossed the placenta from the mother during fetal development.

OR

After birth, a baby can obtain antibodies from a mother's milk if they are breast fed.

d.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>3</b>	<b>Average</b>
<b>%</b>	65	21	12	3	



The correct graph is shown above. Marks were awarded to graphs with the following three features

- three injections therefore three peaks, each higher than the previous **AND**
- response time shortens after each injection **OR** gradient of graph increases **AND**
- after final injection, very slow reduction in antibody production.

Many students drew a graph showing three peaks in antibody levels and a slow reduction in antibody level after the last injection. Some students did not complete the graph, stopping at about 12 months instead of continuing on until 18 months. Fewer students could show either the shorter response time after each injection or the more rapid production of antibodies after each injection.

### Question 8

a.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
<b>%</b>	51	49	

Mitosis

b.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	62	28	10	

Any two of the following features:

- **Presence of hooks**  
Able to attach within tissues at appropriate places and not be swept away by blood or other fluids.
- **Flattened structure – large SA to volume ratio**  
Facilitates absorption of oxygen and food.
- **Flagella or cilia**  
Assists movement when in the blood.
- **Thick outer layer**  
Resist digestion by enzymes.

Some students mentioned features that related to the survival of the species and were not awarded marks. 'Producing large numbers of eggs' was an example of such an incorrect response. Other students gave features of the host that made it suitable for the blood fluke to survive. To be awarded marks the feature had to belong to the blood fluke.

c.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	36	27	37	<b>1</b>

- i Ticks live in an ever changing environment. A fluke lives in an internal environment that is constant in many respects, for example temperature.
- ii A tick burrows through the outer layers of hair or fur and bites into and attaches to the underlying skin to ensure a reasonably constant temperature.

**OR**

- i Fluke lives in environment in which food is constantly available and obtains readily by absorption across its outer layers. External parasite such as a tick must seek out its host.
- ii A tick burrows and bites into and attaches to the underlying skin to ensure they take in as much food as possible. A tick releases its hold and drops off only after it has gorged an immense amount of food compared to its size.

**OR**

- i Tick has to cope with loss of water to the environment compared with fluke that lives in a constantly moist environment.
- ii A tick has a hard external skeleton (exoskeleton) to assist in preventing dehydration

**OR**

- i Tick runs risk of being scratched off by the host animal if they cause itching.
- ii Produce chemicals to inhibit inflammation response.

d.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
<b>%</b>	67	20	13	<b>0.45</b>

Viruses need to enter living cells for their reproductive cycle. On maturity of the viruses within a cell, the cell bursts open, viruses are released and then the cycle is repeated. Every time viruses burst from cells there is a sudden increase in the number of viruses. When the virus is inside the cells the graph is level, running parallel to the horizontal axis.

**AND**

In contrast, bacteria enter a host but are not dependent on any cycle within cells for their reproduction. They show a single ongoing phase of exponential growth indicated in graph X.

Many students understood that a virus must enter a cell before it can reproduce. Few could relate the shape of the graph to the increase in number of viruses after infection.