

# 2017 VCE Biology examination report

## General comments

The 2017 Biology examination was the first examination for the *VCE Biology Study Design 2017–2020*. Section B questions required students to develop answers from the situations provided. This required a thoughtful approach and students at times were required to provide extended answers. Unit 4, Area of Study 3 was important to the examination as students could draw on the knowledge and skills gained from designing and undertaking their own investigations.

Students' examinations were again marked online. Students were required to write within the designated spaces on the pages of the examination, and this requirement was adhered to by most students. It is important that students follow the instructions provided on the examination, in particular using a blue or black pen for Section B to ensure a clear image is provided. If students are asked to annotate or draw a diagram, such as in Questions 1ai. and 9bii., this may be done in pencil so that the answer can be changed if necessary.

Many students presented examinations of an outstanding standard. Students who set out their answers logically were more likely to gain marks than those who produced answers that appeared to be rushed and lacking in thought. It is important that students read questions carefully, plan their answers prior to writing, and use the marks allocated and the answer space given as a guide to the required depth of the answer. Many students answered a question correctly but then contradicted that answer. Students should not repeat the stem of the question in their answers.

Students need to make full use of the reading time; this is a particularly important time for them to understand the information provided and to formulate answers. It was clear that those students who organised their time well were able to convey their knowledge. Many students presented carefully written and well-expressed answers.

While spelling is not directly assessed, if a word has different possible meanings or the word is not identifiable, then the student will not gain the mark.

Students should feel confident to use suitable abbreviations such as DNA, ATP and NADH, and chemical symbols such as H<sub>2</sub>O. If students wish to use another abbreviation and are not sure of its appropriateness, then they should write it out in full.

Teachers and students are reminded that the set of key science skills (refer to pages 10 and 11 of the study design) are examinable, and school-assessed coursework provides students with firsthand experience that can be applied to examination questions.

## Specific information

This report provides sample answers or an indication of what answers may have included. Unless otherwise stated, these are not intended to be exemplary or complete responses.

The statistics in this report may be subject to rounding resulting in a total more or less than 100 per cent.

## Section A – Multiple-choice questions

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

| Question | % A | % B | % C | % D | % No answer | Comments                                                                                                                                                                                                                                                                                                                                                   |
|----------|-----|-----|-----|-----|-------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1        | 68  | 11  | 2   | 19  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 2        | 11  | 77  | 10  | 2   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 3        | 12  | 24  | 8   | 55  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 4        | 11  | 26  | 55  | 8   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 5        | 27  | 48  | 11  | 14  | 0           | ATP is a coenzyme and fructose 6-phosphate is the substrate.                                                                                                                                                                                                                                                                                               |
| 6        | 24  | 32  | 40  | 4   | 0           | The rate of reaction is dependent on the number of active sites of catalase available. Less water would not affect the production of oxygen gas. As catalase comes from a potato, it would be expected that its optimum temperature is closer to 10°C rather than 30°C. The more hydrogen peroxide present, the greater the volume of oxygen gas produced. |
| 7        | 6   | 3   | 85  | 7   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 8        | 16  | 10  | 16  | 59  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 9        | 71  | 16  | 7   | 6   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 10       | 10  | 14  | 59  | 17  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 11       | 8   | 42  | 11  | 38  | 0           | Oxygen is used in the electron transport chain and combines with the hydrogen to form water.                                                                                                                                                                                                                                                               |
| 12       | 11  | 17  | 66  | 6   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 13       | 5   | 12  | 12  | 70  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 14       | 6   | 74  | 4   | 15  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 15       | 9   | 12  | 3   | 76  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 16       | 15  | 6   | 31  | 48  | 0           | NADPH is the loaded form, which requires an input of energy to be produced.                                                                                                                                                                                                                                                                                |
| 17       | 15  | 8   | 70  | 6   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 18       | 89  | 8   | 1   | 2   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 19       | 7   | 25  | 1   | 67  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 20       | 19  | 70  | 8   | 2   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 21       | 2   | 4   | 86  | 7   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 22       | 9   | 73  | 8   | 10  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 23       | 3   | 69  | 10  | 18  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 24       | 7   | 6   | 55  | 32  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 25       | 28  | 7   | 12  | 53  | 1           |                                                                                                                                                                                                                                                                                                                                                            |
| 26       | 85  | 6   | 4   | 4   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 27       | 52  | 34  | 4   | 9   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 28       | 7   | 3   | 12  | 78  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 29       | 5   | 5   | 50  | 40  | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 30       | 0   | 2   | 96  | 2   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 31       | 69  | 21  | 5   | 5   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 32       | 11  | 76  | 6   | 6   | 0           |                                                                                                                                                                                                                                                                                                                                                            |
| 33       | 14  | 6   | 44  | 35  | 0           | Mass extinctions are caused by, for example, a catastrophic event. The changed environment results in different selection pressures, which favour different groups.                                                                                                                                                                                        |

| Question | % A | % B | % C | % D | % No answer | Comments |
|----------|-----|-----|-----|-----|-------------|----------|
| 34       | 7   | 13  | 15  | 65  | 0           |          |
| 35       | 5   | 62  | 12  | 21  | 1           |          |
| 36       | 18  | 78  | 2   | 1   | 0           |          |
| 37       | 23  | 4   | 2   | 71  | 0           |          |
| 38       | 11  | 59  | 20  | 9   | 1           |          |
| 39       | 12  | 3   | 17  | 68  | 1           |          |
| 40       | 17  | 65  | 9   | 9   | 1           |          |

Students are reminded to read each alternative before deciding on their answer. By doing this, they may realise that they have not chosen the correct answer or that they may have misunderstood the question in their first reading.

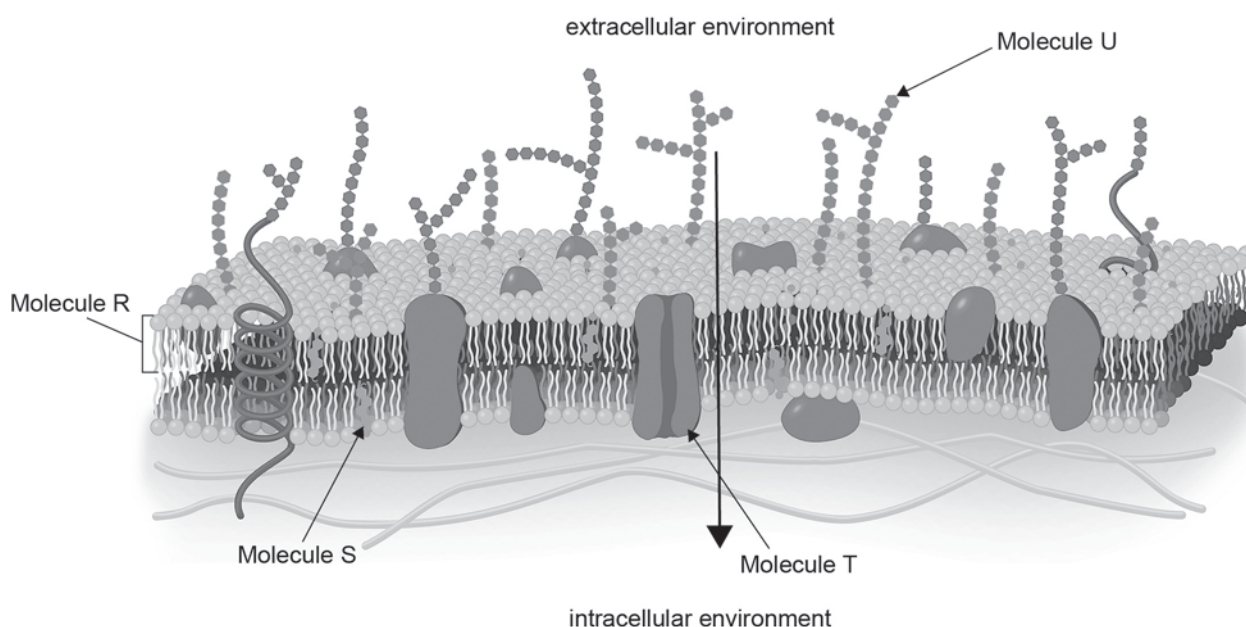
## Section B – Short-answer questions

Areas of concern in Section B included the following.

- Many students did not make comparative statements when required, such as in Question 7a.
- Many answers contained words that were spelt incorrectly. While students' spelling and grammar are not directly assessed, errors in spelling can cause a lack of clarity in meaning and failure to gain marks for the answer. As a general guide, if a word is misspelt but the word is obvious, then it will be accepted.

### Question 1ai.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 43 | 57 | 0.6     |



The arrow passes through the phospholipid bilayer but does not pass through a protein channel/or use a carrier molecule for the passage into the cell.

Students are advised to use a pencil when drawing so that if they change their mind they can erase previous attempts. The arrow needed to go from outside the cell (top) to inside the cell (bottom).

**Question 1aii.**

| Marks | 0  | 1  | 2 | Average |
|-------|----|----|---|---------|
| %     | 54 | 40 | 6 | 0.5     |

Both:

- the molecule is, for example, lipid or non-polar
- passes down the concentration gradient

Students often just restated that the molecule was hydrophobic. When asked to justify, it is important that students provide extra information that is not included in the question.

**Question 1bi.**

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 42 | 58 | 0.6     |

Molecule T

**Question 1bii.**

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 38 | 62 | 0.6     |

Ribosome

Students should have named only one organelle, rather than many different ones.

**Question 1biii.**

| Marks | 0  | 1  | 2  | 3  | Average |
|-------|----|----|----|----|---------|
| %     | 32 | 17 | 11 | 40 | 1.6     |

- condensation reaction
- water is an output
- energy is an input

Many students answered this question incorrectly by referring to translation. If any of the above points were made then it was still possible for them to gain the mark(s) available.

When answering questions such as this, it is advisable that students start their answer with the name of the process being considered.

**Question 1c.**

| Marks | 0  | 1  | 2 | 3 | Average |
|-------|----|----|---|---|---------|
| %     | 74 | 11 | 8 | 7 | 0.5     |

- different post-transcriptional modification or modifications of the pre-mRNA
- different exons are joined or alternative splicing
- different nucleotide sequences/mRNA sequences, code for a different protein
- post-translational changes to the protein; for example, alternative folding

### Question 2a.

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 39 | 21 | 40 | 1       |

For example:

- waxy cuticle of leaves creates a barrier to or traps pathogens
- thick bark creates a barrier to pathogens
- formation of galls limits the spread of pathogens

Many students named a part of a leaf, plant or plant cell, which had a primary role with a different purpose such as the cell wall. The example given could not be a chemical method.

### Question 2b.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 71 | 29 | 0.3     |

It acts as a control to compare the effect of the independent variable.

Students who only wrote 'to act as a control' did not gain the mark. It was important that students acknowledged that Runner A was being compared to a component of Runner B.

### Question 2c.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 37 | 63 | 0.7     |

Either:

- An average of 0.6 cm<sup>2</sup> was eaten in Runner A, compared with an average of 0.15 cm<sup>2</sup> in Runner B.
- Approximately four times as much young leaf area was eaten in Runner A (or vice versa).

Figures needed to be included; units were required in the first example.

This part was well answered and most students correctly used the data provided in the graph to make comparative statements.

### Question 2d.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 76 | 24 | 0.3     |

For example, phenolic acid may make these leaves less tasty to the caterpillar.

Students were required to suggest why and, therefore, had to give a possible explanation as to why the caterpillars preferred these leaves. Many students just stated that 'caterpillars preferred the mature leaves'.

### Question 3a.

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 45 | 39 | 15 | 0.7     |

- identify the molecular cause of a disease/disorder, does not affect any other system or is specific to disease/disorder
- design of a medication (drug) that uses a complementary shape of the molecule to stop a reaction or that binds to the active site/receptor

Many students described the production of, for example a vaccine, which did not score any marks.

### Question 3bi.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 55 | 45 | 0.5     |

The structure must have a shape that is complementary to the active site HMG-CoA reductase or the shape is similar to HMG-CoA.

Some students confused the position of the active site, i.e. referring to the substrate or lovastatin.

Students could have referred to the enzyme or substrate but the majority of students used the correct names given in the question.

### Question 3bii.

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 55 | 32 | 13 | 0.6     |

Both:

- low levels of lovastatin means less competition for the active site
- more substrate is able to bind, increasing the concentration of blood cholesterol

### Question 4ai.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 58 | 42 | 0.4     |

Free of pathogens

Some students wrote very confused answers to this part. They incorrectly stated that sterile meant that there were pathogens present.

### Question 4aii.

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 23 | 43 | 34 | 1.1     |

Two of, for example:

- flaming, steaming, boiling, autoclaving apparatus/equipment
- using antiseptic/antibacterial handwash
- using disposable gloves/equipment

Many suitable and varied answers were given by students. Answers that were not accepted included washing hands and quarantine of patients.

#### Question 4b.

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 39 | 30 | 30 | 0.9     |

Antibodies have shape specific to the antigen, for example, so that macrophages/other immune cells can engulf/destroy it.

#### Question 4c.

| Marks | 0  | 1  | 2  | 3  | Average |
|-------|----|----|----|----|---------|
| %     | 17 | 19 | 32 | 33 | 1.8     |

- passive immunity
- provides antibodies to fight disease
- a joey's immune system is underdeveloped and cannot produce antibodies quickly enough on its own or has no B-memory cells

Students should be aware that this is natural and not artificial immunity. Many students named the type of immunity as passive active but this did not prevent them from gaining further marks if the information was correct.

#### Question 4di.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 55 | 45 | 0.5     |

Non-specific/innate

Second-line defence was also accepted.

#### Question 4dii.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 52 | 48 | 0.5     |

- lysozyme – breaks open bacterial cells
- complement proteins – for example, stimulate phagocytes
- cytokines – control/stimulate other immune cells
- venom inhibitors – would lock onto snake/spider venom molecules and prevent them from reacting

Venom inhibitors was a very common answer but it was very rare for students who gave this answer to gain the mark as answers tended to state that 'they inhibit venom'.

#### Question 4e.

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 42 | 58 | 0.6     |

That it is safe for humans

Some students also gained the mark by demonstrating a sound understanding with an answer such as, 'These peptides could be used instead of antibiotics and used against resistant strains of bacteria that cause human diseases'. Others restated the information given in the stem that 'the milk peptides were 10 times more effective' and did not gain the mark.

**Question 5a.**

| Marks | 0  | 1  | 2  | 3  | Average |
|-------|----|----|----|----|---------|
| %     | 20 | 25 | 39 | 16 | 1.5     |

- Gene flow refers to the movement of alleles between populations by interbreeding.
- The bristlebird is a weak flyer or the populations are geographically isolated.
- The bristlebird is unlikely to interbreed.

Many students incorrectly assumed that gene flow is another name for migration.

**Question 5b.**

| Marks | 0  | 1  | 2  | 3  | Average |
|-------|----|----|----|----|---------|
| %     | 26 | 24 | 30 | 20 | 1.5     |

A small population size would mean a limited gene pool and:

- reduced variation would reduce the chances of survival
- if there were an environmental change the chance of a favourable characteristic existing in the population is unlikely as individuals would all be genetically similar
- there is insufficient variation in the population to survive within their current environment
- inbreeding could result in an increased chance of genetic diseases
- there is a change in allele frequency due to genetic drift.

Students could also have answered the question by demonstrating an understanding of natural selection with respect to the bristlebird, such as 'If there were a predator introduced as the population is genetically similar, there may be no suitable variation present. As the bristlebird is ground-dwelling, their eggs may be eaten and the population would be at risk of extinction'.

**Question 6**

Part a. required a description of the **process** and part b. required a discussion of the **results**.

Many students answered part b. in part a. and then rewrote the answer in part b. It is advisable that students read each part of the question before answering, to avoid wasting valuable time.

**Question 6a.**

| Marks | 0  | 1  | 2  | 3  | Average |
|-------|----|----|----|----|---------|
| %     | 34 | 18 | 31 | 17 | 1.3     |

All:

- DNA is heated to break the bonds/separate the strands.
- Single strands from both species are mixed together and cooled.
- The resulting hybrid DNA is then reheated and the temperature at which the DNA becomes single-stranded is noted.

Many students described PCR (which could have scored one mark) or included a full description in their answer of DNA hybridisation as outlined above (which could have scored full marks); however, this highlighted the need for students to read the question carefully and answer what is being asked and not include the irrelevant description of PCR. The answer space provided should be used as an indication of the length of the required response.

**Question 6b.**

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 54 | 29 | 18 | 0.7     |

The temperature at which the DNA becomes single stranded indicates the degree of complementary base pairing and the higher the temperature the more closely related the two species are.

**Question 7a.**

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 48 | 32 | 20 | 0.8     |

Two of, for example:

The skull shows:

- a flatter face
- a more parabolic jaw
- a relatively larger brain case
- teeth of a more uniform shape.

The skeleton shows upper limbs/forelimbs shorter and hind limbs/legs longer.

The features needed to be comparative. An answer such as central foramen magnum was incorrect; however, more central foramen magnum scored a mark. Incorrect answers included larger brain or features common to all primates such as opposable thumbs.

**Question 7b.**

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 41 | 59 | 0.6     |

Either:

- *Australopithecus* died out before 900 000 years ago or died out more than 2 million years ago.
- *Homo* genus appeared long before 900 000 years ago.

**Question 8a.**

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 16 | 49 | 35 | 1.2     |

- provides parents, doctors, etc. with information
- allows actions such as treatment or diet modification

**Question 8b.**

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 44 | 43 | 13 | 0.7     |

Two of, for example:

- who has access to the data
- the rights of the individual in the future to this information
- the rights of the newborn baby
- privacy of the individual
- whether the data is secure

If students incorrectly discussed the newborn as a fetus, only one mark was awarded for each part.

Many students did not understand that a newborn baby is not a fetus and cannot be aborted. Economic implications were also given, which were unacceptable. It was evident that ethical implications were not understood well. Suitable actions that a society would undertake needed to be considered as many answers did not show an understanding the rights of a newborn and suggested illegal behaviour.

**Question 9a.**

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 79 | 22 | 0.2     |

A means of transferring/transporting foreign/desired DNA into a cell/organism

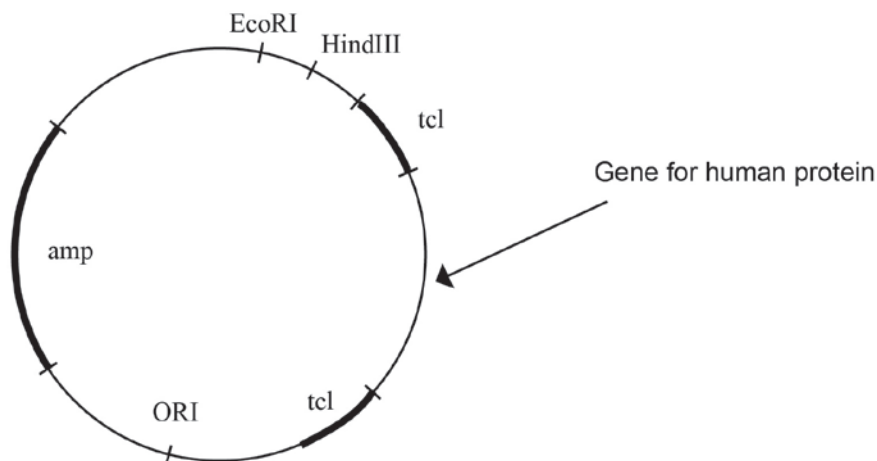
**Question 9bi.**

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 36 | 27 | 38 | 1       |

The restriction enzymes are used to cut the ends of the plasmid and the desired gene so that the gene will insert into the plasmid.

**Question 9bii.**

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 44 | 56 | 0.6     |

**Question 9c.**

| Marks | 0  | 1  | 2  | 3  | Average |
|-------|----|----|----|----|---------|
| %     | 44 | 21 | 24 | 12 | 1.1     |

Grow the bacteria on agar containing ampicillin.

Those bacteria that will grow on agar containing ampicillin have the plasmid with the human gene included.

If plasmid is not taken up, those bacteria are killed by ampicillin.

**Question 10a.**

| Marks | 0  | 1  | 2  | 3  | Average |
|-------|----|----|----|----|---------|
| %     | 24 | 24 | 37 | 15 | 1.5     |

- identification that First Australians burnt the landscape/hunted
- description of consequences of this action, such as the large flightless bird laid eggs on the ground, the burning of the landscape and gathering of eggs by First Australians
- acknowledgment of how the model is supported, such as this led to the extinction of the large flightless bird

Or:

Burning by the First Australians:

- caused a rapid change in the availability of the megafauna's food plants, causing them to die out
- caused the megafauna to die out
- changed the habitat and caused megafauna to die.

The First Australians:

- hunted the megafauna for food

- competed for the same resources used by the megafauna.

**Question 10b.**

| Marks | 0  | 1 | 2 | 3  | 4  | 5  | 6  | Average |
|-------|----|---|---|----|----|----|----|---------|
| %     | 12 | 6 | 9 | 11 | 15 | 18 | 28 | 3.8     |

Any three of the following answers were required for full marks.

| Evidence                                                            | Justification                                                                                      |
|---------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|
| No bottleneck seen in fire-sensitive plants                         | Burning of landscape not causing ecology to be disturbed.                                          |
| Some megafauna was extinct before arrival of the First Australians. | The First Australians were not responsible for rapid megafauna extinction.                         |
| The First Australians coexisted with megafauna for 17 000 years.    | The First Australians did not kill off the megafauna rapidly as they coexisted for a long time.    |
| The population of First Australians was not large.                  | The small population is unlikely to kill all megafauna as it is not putting pressure on resources. |

The justification needed to provide a reason and not just be a repeat of the evidence provided in the written piece.

**Question 11a.**

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 15 | 85 | 0.9     |

Either:

- aerobic or cellular respiration
- anaerobic and aerobic.

**Question 11b.**

| Marks | 0  | 1  | 2  | Average |
|-------|----|----|----|---------|
| %     | 17 | 49 | 34 | 1.2     |

Dependent variables: CO<sub>2</sub> and O<sub>2</sub> levels.

Independent variable: temperature of the chamber/environmental temperature

'Heat lamp' and 'temperature' were not awarded any marks.

**Question 11c.**

| Marks | 0  | 1  | Average |
|-------|----|----|---------|
| %     | 58 | 42 | 0.4     |

To establish a baseline for the experiment

**Question 11d.**

| Marks | 0  | 1  | 2  | 3 | 4 | Average |
|-------|----|----|----|---|---|---------|
| %     | 60 | 12 | 22 | 2 | 4 | 0.8     |

For example:

- Make sure that the experiment is conducted at the same time of day due to cockroaches being more active at different times, therefore could increase aerobic respiration.
- Feed the cockroach the same food each day to ensure the same initial glucose levels, which could affect cellular respiration.
- Ensure that the environment the cockroach is kept in between experiments is the same so that other factors such as external temperature do not affect the cellular respiration rate before the experiment.

**Question 11ei.**

| Marks | 0  | 1 | 2  | Average |
|-------|----|---|----|---------|
| %     | 34 | 8 | 58 | 1.3     |

When the temperature is constant the levels of CO<sub>2</sub> increase sharply and slowly rise with decreasing temperature, and the levels of O<sub>2</sub> decrease sharply and then slowly decrease with decreasing temperature

Students were able to read and interpret the graphs.

**Question 11eii.**

| Marks | 0  | 1  | 2  | 3  | 4  | Average |
|-------|----|----|----|----|----|---------|
| %     | 27 | 23 | 22 | 13 | 15 | 1.7     |

Conclusion

- Aerobic respiration is occurring or the rate of cellular respiration is dependent on the temperature of the chamber.

Evidence:

- Oxygen is an input and is therefore decreasing.
- Carbon dioxide is an output and is therefore increasing.
- Low temperatures lower the rate of reaction.

This question gave students the opportunity to put the information together, drawing on the data given and then providing explanations and conclusions.