

2015 VCE Biology examination report

General comments

Many students presented papers 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 length and depth of the answer. Many students answered the question correctly but then contradicted that answer. Students should not repeat the stem of the question in their answers.

Students approached the examination with confidence, indicating good use of time and use of advice given in previous examination reports. 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.

It is important to again state that students should feel confident to use suitable abbreviations such as DNA, ATP and NADH, and chemical symbols such as H₂O. If students wish to use another abbreviation and are not sure of its appropriateness, then they should define it.

Teachers and students are reminded that the set of key skills (refer to page 12 of the study design) are examinable, and school-assessed coursework provides students with firsthand experience that can be applied to examination questions.

Students' examinations were again marked online. Students were required to write within designated spaces in the question and answer book, and most students adhered to this requirement. It is important that students follow the instructions provided on the examination, in particular using a pen for Section B to ensure a clear image is provided. However, if students are asked to draw diagrams or complete a genetic cross, such as in Questions 1d., 8ci. and 9c. on the 2015 examination, this may be done in pencil, so that the answer can be changed if necessary.

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 | Comments |
|----------|-----|-----|-----|-----|---|
| 1 | 13 | 11 | 68 | 8 | |
| 2 | 4 | 90 | 4 | 2 | |
| 3 | 19 | 2 | 4 | 75 | |
| 4 | 61 | 2 | 19 | 18 | |
| 5 | 5 | 10 | 3 | 82 | |
| 6 | 4 | 77 | 3 | 16 | |
| 7 | 22 | 56 | 3 | 19 | |
| 8 | 1 | 1 | 96 | 2 | |
| 9 | 3 | 9 | 71 | 17 | |
| 10 | 67 | 17 | 4 | 11 | |
| 11 | 3 | 4 | 3 | 90 | |
| 12 | 2 | 2 | 88 | 8 | |
| 13 | 8 | 77 | 3 | 12 | |
| 14 | 16 | 19 | 62 | 3 | |
| 15 | 5 | 55 | 15 | 25 | |
| 16 | 0 | 74 | 1 | 25 | |
| 17 | 2 | 1 | 6 | 90 | |
| 18 | 23 | 2 | 66 | 9 | |
| 19 | 89 | 5 | 4 | 2 | |
| 20 | 61 | 11 | 22 | 5 | |
| 21 | 8 | 8 | 64 | 20 | |
| 22 | 49 | 26 | 9 | 16 | The images were shown in the order in which they occur during meiosis. Image 9. showed homologous chromosomes separating during meiosis 1. Haploid cells are produced at the end of meiosis 1. Chromatids separate during meiosis 2 (images 13. and 14.). |
| 23 | 62 | 8 | 19 | 11 | |
| 24 | 12 | 16 | 10 | 62 | |
| 25 | 5 | 48 | 28 | 19 | |
| 26 | 14 | 4 | 75 | 7 | |
| 27 | 5 | 8 | 7 | 79 | |
| 28 | 3 | 88 | 6 | 3 | |
| 29 | 53 | 4 | 34 | 10 | |
| 30 | 17 | 11 | 10 | 63 | |
| 31 | 4 | 86 | 8 | 2 | |
| 32 | 16 | 42 | 6 | 35 | The inflated pod plants, dominant phenotype, in the F ₁ generation are heterozygous and are test-crossed with the constricted parent, recessive phenotype, resulting in a 1:1 ratio. |
| 33 | 3 | 13 | 76 | 8 | |
| 34 | 69 | 18 | 3 | 9 | |
| 35 | 7 | 7 | 59 | 27 | |
| 36 | 9 | 14 | 12 | 64 | |
| 37 | 67 | 1 | 2 | 31 | |

| Question | % A | % B | % C | % D | Comments |
|----------|-----|-----|-----|-----|---|
| 38 | 13 | 18 | 46 | 23 | Students who selected option D may have confused the term 'hominoid' with 'hominin'. Fossil remains of the genus <i>Australopithecus</i> do not represent the earliest examples of hominoids. |
| 39 | 69 | 12 | 5 | 14 | |
| 40 | 12 | 72 | 9 | 6 | |

Students are reminded to always read each alternative in Section A 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 2a.
- 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 an 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 |
|-------|---|----|---------|
| % | 9 | 91 | 0.9 |

| Structural level of protein | Diagram (A., B. or C.) |
|-----------------------------|------------------------|
| primary | C. |
| secondary | A. |
| tertiary | B. |

Question 1aii.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 16 | 84 | 0.9 |

Amino acid

This question was very well answered.

Question 1b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|---|---------|
| % | 57 | 34 | 9 | 0.5 |

- inability to carry out its function such as electrical impulse not able to pass
- cell contents leaking out
- initiates apoptosis
- organelles no longer being present for cellular reactions
- osmotic gradients disrupted

If students discussed the function, they needed to specifically refer to the neurons' function as given above, rather than making statements such as 'the cell could no longer function and this resulted in its death'. Many students simply restated the information given in the question stem and did not gain any marks.

Question 1c.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 83 | 17 | |

The shape of the chaperone molecule allows it to bind to the protein binding site as it is complementary.

Many students incorrectly gave features of the drug instead of the chaperone protein.

Question 1d.

| | | | | | |
|--------------|----------|----------|----------|----------|----------------|
| Marks | 0 | 1 | 2 | 3 | Average |
| % | 15 | 10 | 19 | 57 | |

Diagrams needed to show:

- the substrate and enzyme correctly
- that the enzyme's active site is changed during denaturation
- the attachment of an inhibitor that prevents the substrate binding.

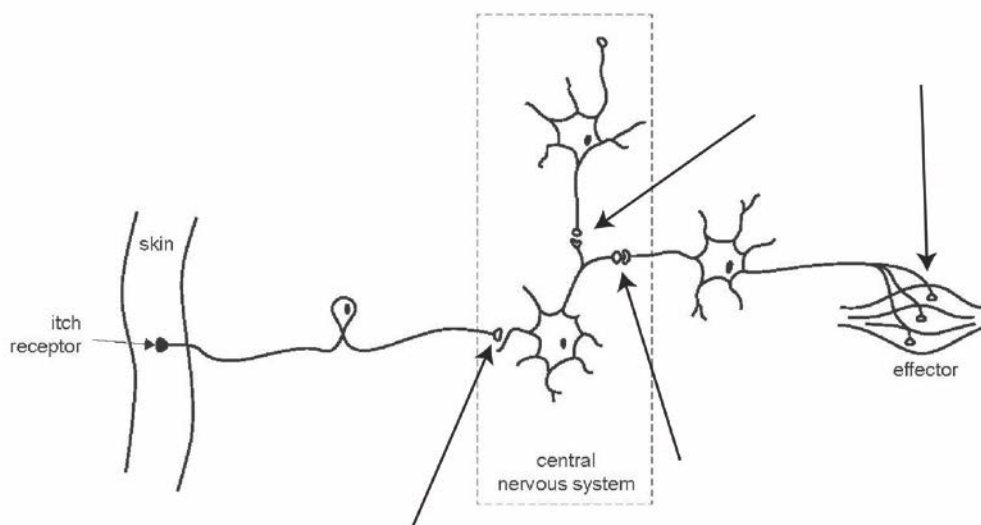
It was evident from many answers that students understood this question clearly. Many students showed both competitive and non-competitive inhibition, but this was not necessary.

Students are advised to draw simple diagrams. While drawing complex diagrams could still receive full marks, students must be mindful of the time taken to do so.

Incorrect answers included showing the substrate being denatured or incorrectly labelling the active site on the substrate.

Question 2ai.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 14 | 86 | |



Students were awarded full marks for one correctly labelled synapse. If more than one synapse was labelled and any of them was incorrect, no mark was awarded.

Question 2aii.

| Marks | 0 | 1 | 2 | 3 | Average |
|-------|----|----|----|----|---------|
| % | 39 | 20 | 19 | 22 | 1.3 |

- Ca^{2+} ions enter the axon terminal.
- Vesicles containing neurotransmitters move to the plasma membrane and are released.
- Neurotransmitters are released by exocytosis (into the synapse).
- Neurotransmitters diffuse across the synapse.
- Neurotransmitters attach to receptors on the post-synaptic membrane.

A common error was that students described the vesicles moving across the synaptic gap.

Some students also described in detail the presence of enzymes to break down neurotransmitters. While they were not penalised for this, this information was unnecessary.

Question 2b.

| Marks | 0 | 1 | 2 | 3 | 4 | Average |
|-------|----|---|---|---|----|---------|
| % | 36 | 4 | 6 | 7 | 47 | 2.3 |

| Name of itch receptor | Receptor location | Chemical nature of signalling molecule | Justification |
|-----------------------|-------------------|---|---|
| H1 | plasma membrane | <ul style="list-style-type: none"> • protein/amino acid/polypeptide based • hydrophilic/lipophobic/polar/water-soluble | Present on the plasma membrane only; indicates that the signalling molecule cannot travel across the plasma membrane. |
| TLR7 | inside the cell | <ul style="list-style-type: none"> • lipid/fatty acid based • steroid • hydrophobic/lipophilic/lipid-soluble/non-polar | Present in the cytosol only; indicates that the signalling molecule can cross the plasma membrane. |

Some students contradicted themselves by giving answers such as 'steroid and polar' and missed out on marks.

Question 3a.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 16 | 84 | 0.9 |

Grana or thylakoid (membrane)

Question 3b.

| Marks | 0 | 1 | 2 | 3 | Average |
|-------|----|----|----|----|---------|
| % | 13 | 18 | 44 | 25 | 1.8 |

| | | |
|---|--|---|
| Name of the stage of photosynthesis that occurs at X | light-dependent stage | |
| Two input molecules that are required for reactions at X | 1. water (Light was not acceptable.) | 2. • ADP • Pi • NADP |
| Two output molecules that result from the reactions at X | 1. oxygen | 2. • ATP • NADPH or H ⁽⁺⁾ (NAD was not acceptable.) |

The question asked for molecules, so light was incorrect. Some students also incorrectly used NAD and NADH.

Question 4a.

| Marks | 0 | 1 | 2 | 3 | 4 | Average |
|-------|----|----|----|----|----|---------|
| % | 15 | 15 | 21 | 28 | 22 | 2.3 |

- a vaccine contains antigens of EVD
- specific antibodies produced or antibodies produced against EVD
- memory cells produced
- future response is (one of):
 - immediate
 - faster
 - greater
- herd immunity

Many students were able to provide responses that were set out well. It was important that students related their answers to the Ebola virus disease (EVD).

Question 4b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 48 | 27 | 24 | 0.8 |

- A humoral response involves B cells and results in the production of antibodies that act against the pathogen.
- A cell-mediated response involves T_c cells/cytotoxic T cells (killing infected cells).

Many students' responses were not detailed enough. It is important to note that T cells are in both immune responses. T_c cells are not NK cells, and the term 'killer cells' is not appropriate.

Students needed to identify which immune response they were referring to. Marks could not be awarded for answers such as, 'One has B cells and the other does not'.

Question 5a.

| Marks | 0 | 1 | Average |
|-------|----|----|------------|
| % | 59 | 41 | 0.4 |

Keeps the lymph flow in one direction/out of the lymph node.

Students were not required to name the structure.

Question 5b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|---|----|------------|
| % | 54 | 5 | 41 | 0.9 |

Students were required to name a cell type of the innate immune response and describe its role. For example:

- phagocytes engulf and destroy pathogens
- mast cells release histamines that cause vasodilation.

Question 5c.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 44 | 30 | 26 | 0.8 |

Students were required to name a cell type of the adaptive immune response and give the function of rough endoplasmic reticulum: making proteins. For example, B cells produce antibodies, rough endoplasmic reticulum produces protein that makes up antibodies.

Some students gave inappropriate cell types, including memory cells and phagocytes. Transport and packaging of proteins was also incorrect (this is a role of the Golgi complex).

Question 6a.

| Marks | 0 | 1 | Average |
|-------|----|----|------------|
| % | 25 | 75 | 0.8 |

Meiosis

Question 6bi.

| Marks | 0 | 1 | Average |
|-------|----|----|------------|
| % | 33 | 67 | 0.7 |

Crossing over or recombination

This process was easily recognised by students.

Question 6bii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 27 | 39 | 33 | 1.1 |

Crossing over leads to the reassortment of alleles from parents and this increased variation may lead to increased survival of the species.

Question 6c.

| Marks | 0 | 1 | Average |
|-------|----|---|---------|
| % | 91 | 9 | 0.1 |

One daughter cell will have two copies of T or one daughter cell will not have any copies of T.

Students were required to make a specific statement rather than a vague statement such as 'there will be genetic variation in the daughter cells'.

Question 7a.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 56 | 44 | 0.5 |

RNA polymerase

Question 7b.

| Marks | 0 | 1 | 2 | 3 | Average |
|-------|----|----|----|----|---------|
| % | 30 | 21 | 24 | 26 | 1.5 |

Transcription product:

- pre-mRNA.

Processing (two of):

- intron removal or exons joined
- addition of a methyl cap/guanine cap
- addition of poly-A tail
- add 5' cap.

or

Transcription product:

- mRNA.

Processing (two of):

- addition of methyl cap
- addition of poly-A tail
- add 5' cap.

If a student wrote only 'capped and tailed' as their explanation, only one mark was awarded.

Question 7c.

| Marks | 0 | 1 | 2 | Average |
|-------|----|---|---|---------|
| % | 94 | 2 | 4 | 0.1 |

Factors expressed by regulator genes could lead to production of the different proteins.

Students were required to relate their answer to how the same genetic sequence could produce different proteins.

Question 7d.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 64 | 36 | 0.4 |

Universal

A common incorrect answer was 'redundant'. Many students identified the code as universal and then contradicted themselves by then adding 'as the four bases are the same for all organisms'.

Question 8a.

These questions required students to carefully read and analyse the information, and apply their knowledge.

Question 8ai.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 77 | 23 | 0.3 |

Eight

Question 8aii.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 74 | 26 | 0.3 |

AAT changed to ATT or ACT

Question 8b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 49 | 36 | 14 | 0.7 |

The shaded male in generation III inherited a mutation from one of his parents, and this allele was passed on to his affected children.

Many students reasoned that the shaded male's parents were carriers and the condition was recessive or sex-linked recessive, but this was contrary to the information supplied in the stem of the question.

Question 8ci.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 60 | 18 | 22 | 0.7 |

| Crossing-over event between <i>R</i> and <i>B</i> loci | Genotype of gametes | | | |
|--|---------------------|-----------|-----------|-----------|
| | 1 | 2 | 3 | 4 |
| does not occur | <i>BR</i> | <i>br</i> | | |
| does occur | <i>BR</i> | <i>br</i> | <i>bR</i> | <i>Br</i> |

Some students made a mistake in one genotype; for example, *Rr*. Others simply repeated their answers for the 'does occur' genotype in the 'does not occur' row.

Question 8cii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 43 | 40 | 17 | 0.8 |

Br
bR

Br would lead to offspring with white eyes and straight bristles, and *bR* would lead to offspring with red eyes and crooked bristles.

Question 9a.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 24 | 76 | 0.8 |

Divergent

This was correctly identified by the majority of students. 'Convergent' was a common incorrect answer.

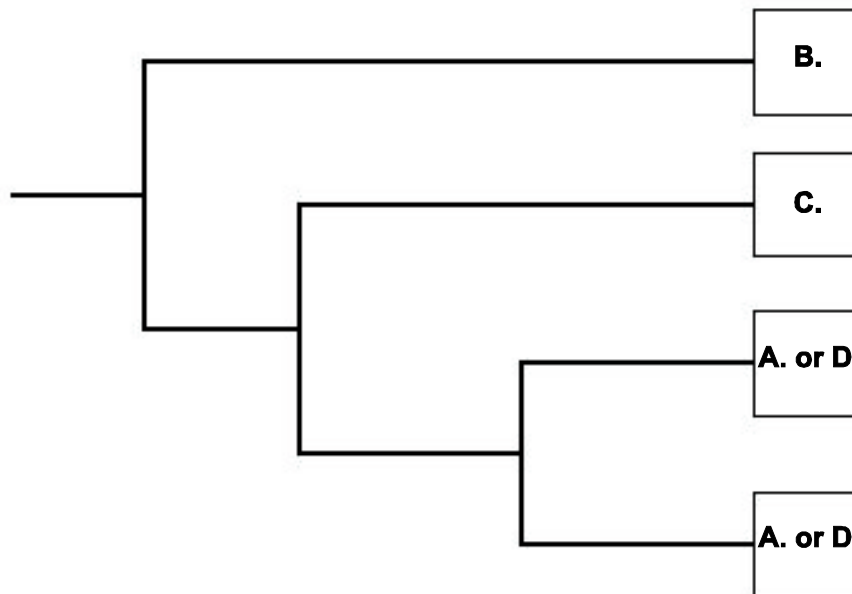
Question 9b.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 86 | 14 | 0.2 |

Comparative anatomy

Question 9ci.

| Marks | 0 | 1 | 2 | Average |
|-------|----|---|----|---------|
| % | 26 | 5 | 69 | 1.5 |



Question 9cii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 24 | 18 | 58 | 1.4 |

- *I. major* and whales share a recent common ancestor and pigs have two differences to *I. major*.
- Hippopotami have one difference.

Some students had the order of responses to 9ci. in reverse (which was not awarded any marks) but gave a correct explanation and were awarded full marks for this part.

Question 10a.

In Question 10ai., students were required to provide a plausible hypothesis and in Question 10aii., provide two pieces of information to support their hypothesis.

Question 10ai.

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

For example, that the change in salinity of the lake over time caused the fish to change.

Question 10aii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 55 | 23 | 22 | 0.7 |

For example:

- The fish in the lowest layer show characteristics similar to those found in freshwater today.
- The top layer contained the most recent fossils, which shows that the lake became freshwater again.

Question 10b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 29 | 41 | 30 | 1 |

The fish with smaller pelvises and no spines grow more quickly. They are able to move faster and avoid predation as young fish. They reproduce stickleback offspring with small pelvises and no dorsal spines.

Many students simply restated the information from the question stem, 'The fish with smaller pelvises and no spines grow more quickly and move faster', and failed to outline how this occurred.

Question 11ai.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 31 | 45 | 24 | 0.9 |

- Interbreeding occurred between *H. neanderthalensis* and ancestors of (present-day European, East Asian and Australian Aboriginal) *H. sapiens*.
- DNA was passed from one generation to the next.

Many students correctly identified that gene flow occurred. Others, however, incorrectly identified this as genetic drift.

Question 11aii.

| Marks | 0 | 1 | Average |
|-------|----|----|---------|
| % | 60 | 40 | 0.4 |

They are not separate species.

Question 11b.

| Marks | 0 | 1 | 2 | 3 | Average |
|-------|----|----|----|----|---------|
| % | 43 | 24 | 19 | 15 | 1.1 |

Out of Africa

Humans first evolved in Africa where there were no Neanderthal populations as there is no Neanderthal DNA in populations in Africa, and populations of humans moved out Africa and encountered other Homo species. This is supported by the presence of *Homo neanderthalensis* DNA in all modern humans except African populations.

Question 11c.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 18 | 33 | 49 | 1.3 |

Route: Such as:

Africa → Middle East → East Asia → Australia

or

Europe → East Asia → Australia

Timing: Migration occurred sometime less than 80 000 years ago

Students could readily interpret the given information to answer this question.