2016 VCE Biology examination report

General comments

The 2016 Biology examination was the final examination for the *VCE Biology Study Design 2013–2016*. 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 draw a diagram or complete a genetic cross, such as in Question 7c., this may be done in pencil so that the answer can be changed if necessary.

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 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 appeared to be well prepared for the examination, making good use of time and use of advice given in previous examination reports. It was clear that students had organised their time well and used the opportunity 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_2O. 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 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.

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	11	6	76	8	
2	2	6	3	90	
3	3	93	2	1	
4	0	1	93	5	
5	7	90	2	1	
6	55	3	11	30	
7	19	69	8	5	
8	96	1	1	1	
9	1	98	1	0	
10	2	26	51	20	
11	8	14	69	8	
12	73	10	9	8	
13	2	12	3	82	
14	15	16	49	21	
15	5	6	2	86	
16	76	9	9	6	
17	18	8	4	70	
18	57	10	15	18	
19	7	83	7	2	
20	80	7	3	10	
21	7	4	1	88	
22	90	9	1	0	
23	2	2	27	69	
24	68	2	23	7	
25	8	7	9	75	
26	11	60	9	19	
27	10	12	69	9	
28	3	16	76	6	
29	72	6	15	6	
30	5	85	4	6	
31	9	4	11	76	
32	14	8	68	11	
33	62	4	29	6	
34	17	5	10	67	
35	9	11	68	12	
36	3	79	3	15	
37	4	74	6	16	
38	3	6	47	44	Many students chose option C. Carbon dating is generally useful to date fossils younger than 60 000 years. These fossils are 290–245 million years old.
39	93	4	1	1	
40	7	4	9	79	

Students are reminded to always 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 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 the answer. As a general guide, if a word is misspelt but the word is obvious, then it will be accepted.

Question 1a.

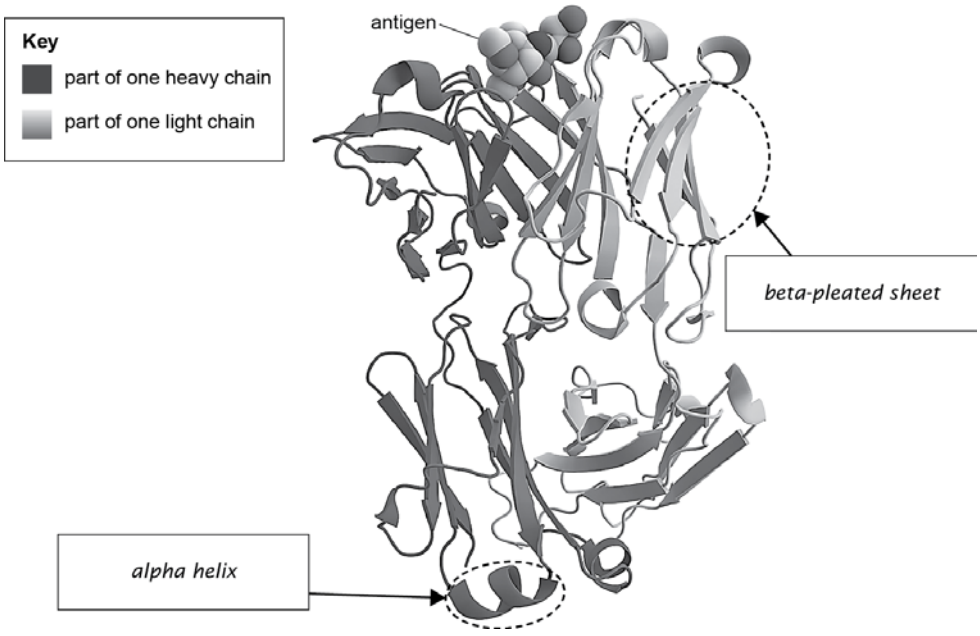
Marks	0	1	Average
%	29	71	**0.7**

Amino acid

This question was very well answered.

Question 1b.

Marks	0	1	2	Average
%	29	15	55	**1.3**



Students could have used symbols for alpha and beta.

Alpha coil and beta sheet were not accepted.

Question 1c.

Marks	0	1	2	Average
%	60	28	12	**0.5**

A quaternary structure has two or more polypeptide/protein chains, as evident by the presence of the heavy and light chains.

A common incorrect response made mention of tertiary structures being a component. Another incorrect response was ‘two or more proteins joined together’.

Question 2a.

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

To provide energy or ATP

Question 2b.

Marks	0	1	Average
%	50	50	**0.5**

- ethanol/alcohol
- carbon dioxide
- ATP

Energy was not an acceptable answer.

Question 2c.

Marks	0	1	2	3	4	Average
%	36	31	23	7	3	**1.1**

- independent variable: presence or absence of furfural
- experiment set up with same amount of glucose
- experiment set up with same amount of alcohol dehydrogenase
- dependent variable: measure the amount of product produced; for example, carbon dioxide

Students who were able to understand the information and identify the key components of experimental design scored at the highest level. Many students were confused by the terms and their responses lacked clarity.

Question 2d.

Marks	0	1	2	Average
%	27	22	51	**1.3**

Furfural:

- has a shape complementary to the active site of alcohol dehydrogenase
- prevents the substrate from attaching to the enzyme.

Question 3a.

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

Signal transduction

This concept was understood well by most students.

Question 3b.

Marks	0	1	2	Average
%	32	23	45	**1.2**

Two of:

- nucleus – production of mRNA for synthesis of proteins, replication of DNA for cell reproduction
- ribosomes – production of proteins for secretion or for cell reproduction or control
- rough endoplasmic reticulum – production and transport of protein
- Golgi apparatus – export of collagen protein
- mitochondria – provide energy; for example, for cell reproduction

Students were required to name an organelle and relate it to a specific purpose or activity.

Question 3c.

Marks	0	1	2	3	Average
%	41	24	22	13	**1.1**

Possible answers included:

- enzymes; for example, caspases are activated within the cell
- digestion of cell contents
- cell shrinkage
- cell blebbing
- cell breaks up
- cell signals macrophages.

Phagocytosis of cell debris was not accepted.

Question 4

Marks	0	1	2	3	4	5	6	Average
%	26	23	13	7	6	9	16	**2.4**

Experiment 1 – Suspension of mitochondria

Substance added	Change in oxygen concentration (increase/decrease/no change)	Reason
glucose	no change	Glucose is not metabolised (broken down) by the mitochondria.
pyruvate	decrease	Pyruvate is a substrate of the Krebs

		cycle.

Experiment 2 – Cytosol of cells from which the mitochondria had been removed

Substance added	Change in oxygen concentration Increase/decrease/no change	Reason
glucose	no change	Glycolysis is anaerobic (or glucose converted to pyruvate but no mitochondria so oxygen is not used).
pyruvate	no change	No aerobic breakdown of pyruvate.

Experiment 3 – Suspension of mitochondria and cytosol of cells

Substance added	Change in oxygen concentration Increase/decrease/no change	Reason
glucose	decrease	Glucose is converted into pyruvate, which is metabolised by the mitochondria using oxygen.
pyruvate	decrease	Pyruvate is metabolised by the mitochondria in a process that uses oxygen.

Students were required to give a correct change and a correct reason to gain one mark for each situation. However, if a reason was incorrect or not given, students could still gain a mark for every two correct changes.

Question 5a.

Marks	0	1	Average
%	41	59	**0.6**

An attenuated virus that triggers an immune response

Some students incorrectly stated that antibodies were in the vaccine.

Question 5b.

Marks	0	1	2	Average
%	23	48	29	1.1

- to form B memory cells
- to allow time for the immune system to produce antibodies

Question 5c.

Marks	0	1	2	3	4	Average
%	19	14	23	13	31	2.3

Name of cell type 1: T memory

Role: T memory cells survive for many years and proliferate rapidly into Th and Tc cells when the body is exposed to a pathogen for the second time, mounting a quicker and stronger response.

Name of cell type 2: B memory

Role: B memory cells will rapidly divide and form new antibody-producing plasma cells.

Question 6ai.

Marks	0	1	Average
%	40	60	0.6

tRNA

Transport RNA was not a suitable answer.

Question 6aii.

Marks	0	1	2	3	Average
%	46	14	17	23	1.2

- tRNA has a specific amino acid
- carries amino acid to ribosome
- tRNA anticodon attaches to mRNA codon
- then amino acids are joined

Question 6b.

Marks	0	1	2	3	Average
%	43	15	19	23	1.2

- DNA unwinds/unzips
- RNA polymerase catalyses transcription
- transcription of DNA template into Molecule W
- Molecule W is complementary to the DNA strand
- in Molecule W, A pairs with U, not with T or it has no thymine

Question 7a.

Marks	0	1	Average
%	46	54	**0.6**

Genes are on separate chromosomes or are far apart on the same chromosome.

Question 7b.

Marks	0	1	2	Average
%	28	5	67	**1.4**

ggAA or ggAa

Question 7c.

Marks	0	1	2	3	4	Average
%	28	11	14	12	35	**2.2**

Parents: GgAa × GgAa or correct gametes shown in working

	GA	Ga	gA	ga
GA	GGAA	GGAa	GgAA	GgAa
Ga	GGAa	GGaa	GgAa	Ggaa
gA	GgAA	GgAa	ggAA	ggAa
ga	GgAa	Ggaa	ggAa	ggaa

Phenotypes in offspring – grey: 9, black: 3, white 4

Some students did not recognise that white fur was due to the absence of the A allele, as given in the stem.

Question 8a.

Marks	0	1	2	3	4	Average
%	21	31	25	17	7	**1.6**

- Variation existed between individuals in the ancestral group of sea stars.
- The water temperature changed.
- Different selective pressures act on southern populations compared to the northern populations, such as southern populations became exposed to cold-water predators.
- Surviving individuals in each of the populations reproduced and could pass on the advantageous feature.

Students would have benefitted from planning their answer prior to writing it.

Some students incorrectly treated this as a speciation question, when in fact speciation had already occurred.

Question 8b.

Marks	0	1	2	Average
%	10	38	51	**1.4**

- *Cryptasterina pentagona*
- For example, two individuals provide genetic material to the offspring

Many students incorrectly stated that only sexual reproduction occurred in this species, when both species undergo sexual reproduction.

Question 9a.

Marks	0	1	2	Average
%	52	34	14	**0.6**

- The hypothesis is supported as the average skull measurements in population B are different from those in population A. For example, in position 1 the difference is 20 mm.
- The differences in measurements in the three other species are smaller.

Students were required to make reference to the data provided in the table to justify their answer.

Question 9b.

Marks	0	1	2	Average
%	58	18	24	**0.7**

One of:

- Comparison of DNA sequences: evidence to support their hypothesis would be differences in the nucleotide sequences within the DNA molecules or evidence from DNA hybridisation studies
- Comparison of mitochondrial DNA: evidence to support their hypothesis would be differences in the nucleotide sequences within the DNA molecules
- Comparative genomics (comparison of whole genome sequences): evidence to support their hypothesis would be differences within the gene sequences of the two populations

Question 9ci.

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

A geographical barrier

An incorrect answer related to food availability.

Question 9cii.

Marks	0	1	2	Average
%	50	36	15	**0.7**

- prevents the two populations from breeding together – no gene flow
- different selective pressures may act on the populations

Most students recognised that gene flow did not occur but missed the second point.

Question 10a.

Marks	0	1	2	Average
%	21	32	47	**1.3**

Species	Environment	Condition
H. erectus georgicus	*near the banks of the Black Sea*	For example: • low oxygen • burial in sedimentation • lack of scavengers/decomposers • highly mineralised water.
H. naledi	*cave in South Africa*	For example: • constant humidity • constant temperature • no scavengers/decomposers/predators • no wind/no water/no sunlight.

Some students did not adhere to the directive in the question and used the same condition for both species.

Question 10b.

Marks	0	1	2	Average
%	19	36	45	**1.3**

Any two of:

- forehead slopes more
- face is less flat
- brow ridges prominent
- more prominent zygomatic arches
- teeth types are different sizes
- skull is less rounded
- U-shaped jaw/less parabolic.

The position of the foramen magnum was not deemed to be a suitable response as it was not discernible in the photograph.

Question 10c.

Marks	0	1	Average
%	70	30	**0.6**

One of:

- change in pelvis shape to support body in more upright position
- S-shaped spine
- shorter arm-to-leg ratio
- large heel bone.

Some students were confused when using ratios. To avoid confusion, in this case, students could have stated that the arms are shorter than the legs.

The question specifically stated ‘other than skull structure’; therefore, the position of the foramen magnum was not a suitable answer.

Question 10d.

Marks	0	1	2	Average
%	11	20	69	**1.6**

Any two of:

- art/artefacts
- stone tools
- positioning of the bodies to indicate burial
- fashioned shell or bone objects.

Students were not required to describe their choice to gain the mark; for example, cave paintings.

Question 11a.

Marks	0	1	Average
%	41	59	**0.6**

Any one of the following:

- it is unethical
- against religious beliefs
- public sentiment against it
- the gene could be inserted in the incorrect spot on the genome so that it might affect other genes
- it could affect the foetus in unusual ways
- it could cause long-term side effects not yet known
- since the effects are on persons not yet born, these people have no choice.

Many students were able to provide a suitable issue.

Question 11bi.

Marks	0	1	2	Average
%	59	34	7	**0.5**

Protein is correctly produced and the protein is functional.

Question 11bii.

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

- Only cells that have been successfully altered will be injected back into the patient.
- Viral vector is not being exposed to all cells.