

2014

Biology GA 3: Examination

GENERAL COMMENTS

This examination was the second examination of the combined Units 3 and 4 for the *VCE Biology Study Design*. Students' examinations were again marked online. Students were required to write within designated spaces on the pages of the question and answer book and most students adhered to this requirement. Students are reminded to confine their answer to the question being asked as extra and irrelevant information was often included. 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. If students are asked to draw a diagram or complete a genetic cross, this may be done in pencil, so that the answer can be changed by the student 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 were often contradictory. 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 of the 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. 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.

It is important to again state that students should feel confident to use suitable abbreviations such as DNA, ATP and chemical symbols such as H₂O. If students wish to use another abbreviation and are not sure of its appropriateness, then they should provide a definition before using 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 such as Question 2b.

Resources to support VCE Biology are available on the Biology study page of the VCAA website. These resources are updated regularly and include articles and relevant website links.

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 errors resulting in a total 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
1	6	3	89	3
2	7	9	68	15
3	93	3	1	3
4	2	90	1	6
5	3	72	8	16
6	98	1	0	1
7	11	75	7	7
8	8	4	12	76
9	4	8	86	1
10	71	9	10	10
11	27	8	29	35
12	10	39	7	43
13	5	3	81	11
14	1	5	92	2
15	6	85	6	3

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Question	% A	% B	% C	% D
16	83	5	5	7
17	6	13	5	75
18	2	25	53	20
19	11	78	10	1
20	35	14	48	4
21	6	14	1	79
22	78	2	8	12
23	7	65	6	22
24	10	9	71	10
25	69	22	6	4
26	4	87	4	5
27	58	26	9	7
28	7	69	16	8
29	6	25	52	17
30	12	77	7	4
31	10	3	4	83
32	22	4	66	7
33	54	40	3	3
34	17	3	78	2
35	22	4	12	62
36	60	5	11	24
37	13	12	73	2
38	12	2	9	77
39	4	62	13	21
40	13	8	77	2

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 best answer or that they may have misunderstood the question in their first reading.

Section B – Short-answer questions

General 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 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 1a.

Marks	0	1	2	Average
%	31	32	37	1.1

ATCase catalyses the reaction of joining A and B, producing D, and lowers the activation energy.

Students were required to make reference to this reaction and not, as some did, make general comments on enzyme function. An incorrect answer was 'that less energy is required for the reaction'.

Question 1bi.

Marks	0	1	Average
%	8	92	0.9

The rate of production of D is decreased.

Question 1bii.

Marks	0	1	2	3	Average
%	54	21	15	11	0.8

Suitable responses included:

- CTP binding to ATCase acts as an inhibitor
- the shape of the active site is changed

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- substrate no longer binds
- as the final product increases, the first step in the pathway decreases, thus regulating the reaction.

Students were required to answer at the molecular level and to explain their answer; however, many students were unable to do so.

Question 2a.

Marks	0	1	2	Average
%	18	30	52	1.4

N and B passed through the nuclear membrane and accumulated in the nucleus, and polypeptides without the sequence did not.

Students were required to make comparative statements using the information in the table to support the hypothesis. Statements such as 'some sequences passed into the nucleus and others did not' were not awarded any marks.

Question 2b.

Marks	0	1	2	3	Average
%	34	22	32	12	1.2

Some necessary steps were:

- one group provided with polypeptides containing Lys in position 3 and the other group having a different amino acid in position 3
- record which polypeptides accumulate in the nucleus
- repeat the experiment or have multiple set-ups.

The stem of the question stated that large samples of identical cells were used and that all cells were kept under the same environmental conditions; however, some students repeated this information, indicating that more careful reading of the information was required.

Question 3a.

Marks	0	1	2	Average
%	47	15	38	0.9

The hormone binds to a receptor on the cell membrane and the signal is transduced by, for example, G proteins, a second messenger or a cascade of events.

Some students did not recognise that the word 'hydrophilic' in the question indicated that the hormone was water-soluble.

Question 3b.

Marks	0	1	2	Average
%	23	35	42	1.2

Glucose moves through protein channels and along the concentration gradient.

Some students incorrectly stated that the glucose moved against or up the concentration gradient.

Question 3c.

Marks	0	1	2	Average
%	15	64	21	1.1

Heart muscle cells would have large numbers of mitochondria, in which aerobic respiration occurs, producing ATP.

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Question 4a.

Marks	0	1	Average
%	72	28	0.3

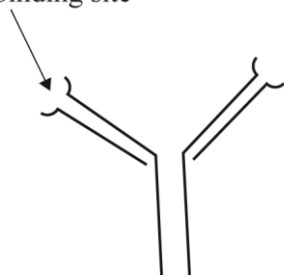
A pathogen is a causative agent of disease.

Many students made reference only to pathogens being cellular or organisms causing disease. Prions and viruses are non-cellular and agents that cause disease.

Question 4b.

Marks	0	1	2	Average
%	39	31	30	0.9

antigen-binding site

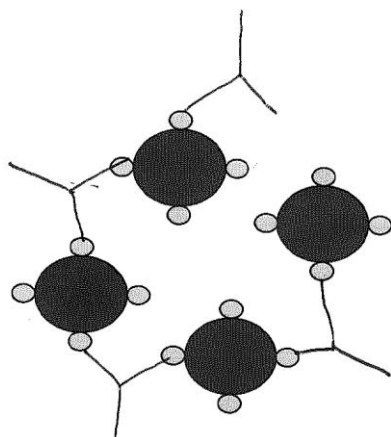


Students' diagrams needed to show the four polypeptide chains correctly drawn and an appropriately shaped antigen-binding site that was labelled.

Students had difficulty drawing the four chains correctly but could more easily label the antigen-binding site. Incorrect labels included active site or receptor site.

Question 4ci.

Marks	0	1	2	Average
%	25	11	64	1.4



Students were required to show:

- four antibodies
- antibodies connected to the antigen.

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Question 4cii.

Marks	0	1	2	Average
%	40	30	30	0.9

Suitable responses included:

- immobilises the pathogen
- agglutinates the pathogen
- allows phagocytes to engulf the pathogen.

Question 5a.

Marks	0	1	2	Average
%	20	39	41	1.2

The father's phenotype is Rh positive and his genotype is DD or Dd. The child will be heterozygous.

Some students gave the chance of the child being affected but this was not required.

Question 5b.

Marks	0	1	2	Average
%	30	31	40	1.1

B memory cells are produced during the first pregnancy and a larger or more rapid response occurs during the second pregnancy.

Question 5c.

Marks	0	1	2	Average
%	39	42	19	0.8

Passive immunity (no mark was awarded for this) and both of:

- no memory cells produced by the mother
- the mother does not produce her own antibodies.

Question 6a.

Marks	0	1	Average
%	38	62	0.6

Both of:

- female worker bee: 32
- male drone bee: 16.

Question 6b.

Marks	0	1	2	Average
%	42	33	24	0.8

Students were required to describe events in the context of the question that produce genotypic variation, such as:

- eggs are produced by meiosis
- mutation produces new alleles
- crossing over mixes the alleles of linked genes.

Question 6c.

Marks	0	1	Average
%	40	60	0.6

Genetic variation gives some members of a species a greater chance of survival than others.

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Question 7a.

Marks	0	1	2	3	Average
%	33	14	19	34	1.6

A good response included the following steps:

- ribosomes use the mRNA code
- tRNA brings a specific amino acid to the ribosome
- tRNA anticodon joins to complementary mRNA codon
- an amino acid is added to the polypeptide chain.

Some students were able to describe the steps with confidence.

Question 7b.

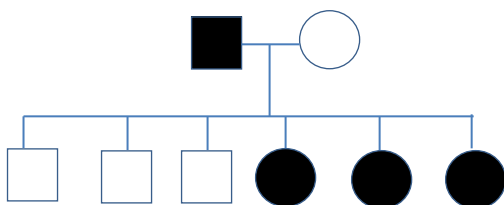
Marks	0	1	2	Average
%	47	13	40	0.9

Three nucleotide bases code for one amino acid and 270 bases in total.

Students were required to name the monomer. Totals of 273 and 276 were also accepted (three bases for 'stop' or six bases extra for 'start and stop').

Question 8a.

Marks	0	1	Average
%	27	73	0.8



Question 8b.

Marks	0	1	2	3	Average
%	33	19	26	22	1.4

Mode of inheritance: autosomal recessive

Reason 1: recessive, parents II-5 and II-6 are unaffected but have an affected child.

Reason 2: autosomal, mother I-2 does not pass the trait to all of her sons.

Question 8c.

Marks	0	1	2	Average
%	54	33	13	0.6

Traits are the same as the twins are genetically identical but are also different due to the influence of the environment.

Some students stated that the twins had similar or different genotypes or alleles, but this was incorrect.

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Question 9a.

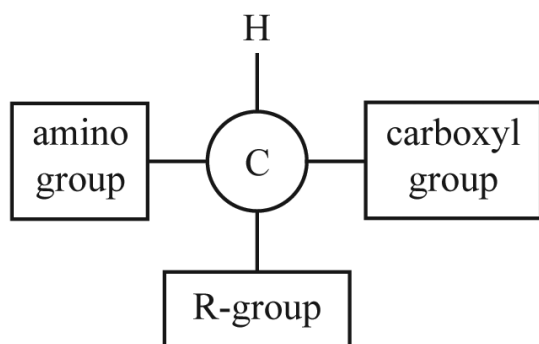
Marks	0	1	2	3	4	Average
%	25	17	19	16	23	2

Macromolecule 1: protein

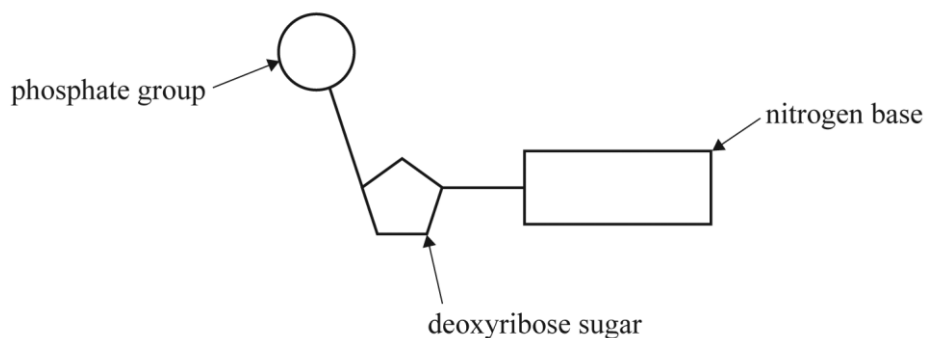
Macromolecule 2: nucleic acid

Students were required to draw two labelled diagrams to illustrate the general structure of the monomers of these macromolecules:

- a simple representation of an amino acid including an amino, carboxyl and R-group. For example:



- a simple representation of a nucleotide including deoxyribose, phosphate and nitrogen base.



Deoxyribose was necessary rather than sugar. Ribose was incorrect.

Question 9b.

Marks	0	1	Average
%	41	59	0.6

Different. There are only 45 chromosomes illustrated (or a suitable explanation such as missing a [named] chromosome).

The answer 'does not contain 46 chromosomes' did not contain enough detail for students to be awarded the mark.

Question 10a.

Marks	0	1	2	Average
%	32	40	29	1

Parents: $Z^R Z^r$ $Z^r W$

Offspring genotypes: $1Z^R Z^r$: $1Z^R W$: $1Z^r Z^r$: $1Z^r W$

Offspring phenotypes and ratios:

1

1

1

1

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male with red head feathers : female with red head feathers : male with black head feathers : female with black head feathers

Question 10b.

Marks	0	1	2	Average
%	23	19	58	1.4

Offspring genotypes and ratios:

$\frac{1}{Bb}$: $\frac{1}{Bb}$: $\frac{1}{b'b}$: $\frac{1}{bb}$

Offspring phenotypes and ratios:

$\frac{2}{\text{purple breast feathers}}$: $\frac{1}{\text{lilac breast feathers}}$: $\frac{1}{\text{white breast feathers}}$

Question 11a.

Marks	0	1	2	3	Average
%	40	10	13	38	1.5

A good response included the following steps:

- heat DNA to approximately 90 °C
- cool to attach primers
- taq polymerase copies strands
- process is repeated many times.

Question 11bi.

Marks	0	1	Average
%	4	96	1

Sample 3

Question 11bii.

Marks	0	1	Average
%	13	87	0.9

Blood samples came from other people or from animals.

Question 11c.

Marks	0	1	2	Average
%	50	37	13	0.7

- Over a longer time, mutations accumulate that may change the sequence of amino acids.
- The more differences in the amino acid sequence, the less related the two species are.

Many students did not answer the question with the relevance of amino acid differences and also did not make the link to evolutionary relationships.

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Question 11d.

Marks	0	1	2	Average
%	29	34	37	1.1

Possible answers included:

- freed the hands for:
 - toolmaking
 - carrying young.
- reaching higher food
- raising head to scan for predators
- cultural behaviour such as ceremony.

The effects needed to relate to behaviour. Some students incorrectly described the physiological features that enabled bipedalism.

Question 12a.

Marks	0	1	2	Average
%	14	47	39	1.3

Students needed to state that a selection pressure is a factor in an organism's environment that removes unsuited individuals and provide a suitable example such as humans acting as hunters. The selection pressure needed to refer to mammoths.

Question 12bi.

Marks	0	1	2	3	Average
%	44	22	18	17	1.1

Either of:

- Allopatric speciation
 - Mammoth ancestors left Africa.
 - Over a long period of time genetic differences accumulated.
 - Characteristics of the species changed through natural selection due to different environment.
- Speciation
 - Within the original species, genetic differences accumulate.
 - Through natural selection individuals with suitable characteristics survived and reproduced.
 - Due to a survival advantage, this group developed and over time evolved.

Many students struggled with this question; however, those who followed one of the above approaches and developed a reasoned answer gained full marks.

Question 12bii.

Marks	0	1	2	Average
%	35	43	23	0.9

Suitable responses included:

- *M. primigenius* had limited genetic variation and due to, for example, increased hunting by humans, was unable to evolve.
- *E. maximus* lived in an environment with more stable selection pressures.