



GENERAL COMMENTS

This examination was the first examination combining both Units 3 and 4. 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 depth of the answer. Students should not repeat the stem of the question in their answers.

Students approached the examination with confidence, suggesting good use of time and use of advice given in previous exam 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 was pleasing to see that most students coped with the new format of the examination.

Students should follow the instructions in the examination and write within the designated answer spaces using black or blue pen. Students should feel confident to use suitable abbreviations such as DNA, ATP, 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 such as Question 12.

Resources to support VCE Biology are available on the Biology study page on the VCAA website.

SPECIFIC INFORMATION

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 | 2 | 94 | 2 | 2 |
| 2 | 5 | 92 | 2 | 1 |
| 3 | 87 | 2 | 9 | 2 |
| 4 | 21 | 11 | 9 | 59 |
| 5 | 2 | 11 | 13 | 74 |
| 6 | 2 | 87 | 3 | 8 |
| 7 | 4 | 5 | 90 | 1 |
| 8 | 52 | 24 | 21 | 2 |
| 9 | 4 | 4 | 25 | 67 |
| 10 | 24 | 16 | 53 | 5 |
| 11 | 5 | 69 | 14 | 13 |
| 12 | 1 | 3 | 26 | 71 |
| 13 | 1 | 95 | 2 | 1 |
| 14 | 80 | 3 | 4 | 13 |

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| Question | % A | % B | % C | % D |
|----------|-----|-----|-----|-----|
| 15 | 27 | 11 | 32 | 29 |
| 16 | 83 | 16 | 1 | 0 |
| 17 | 2 | 91 | 2 | 5 |
| 18 | 16 | 4 | 75 | 4 |
| 19 | 4 | 71 | 10 | 14 |
| 20 | 28 | 42 | 19 | 11 |
| 21 | 4 | 67 | 20 | 8 |
| 22 | 6 | 6 | 5 | 83 |
| 23 | 61 | 27 | 10 | 3 |
| 24 | 3 | 5 | 12 | 80 |
| 25 | 50 | 44 | 5 | 1 |
| 26 | 18 | 20 | 57 | 5 |
| 27 | 6 | 19 | 8 | 67 |
| 28 | 2 | 83 | 14 | 1 |
| 29 | 81 | 11 | 5 | 3 |
| 30 | 7 | 13 | 67 | 13 |
| 31 | 12 | 13 | 71 | 4 |
| 32 | 80 | 13 | 4 | 2 |
| 33 | 2 | 3 | 6 | 89 |
| 34 | 2 | 4 | 79 | 15 |
| 35 | 11 | 73 | 13 | 3 |
| 36 | 41 | 20 | 13 | 26 |
| 37 | 14 | 53 | 10 | 23 |
| 38 | 2 | 3 | 7 | 87 |
| 39 | 23 | 14 | 4 | 59 |
| 40 | 11 | 9 | 63 | 17 |

Section B – Short-answer questions

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.

Areas of concern in Section B included the following.

- Many students did not make comparative statements when required, such as in Question 11a.
- Many answers contained words that were spelt incorrectly. While students' spelling and grammar are not assessed, errors in spelling can cause a lack of clarity in meaning. As a general guide, if a word is misspelt but the word is obvious, then it will be accepted.

Question 1

Question 1 was generally well answered. Students could clearly answer the questions asked and provide suitable answers. There were, however, examples where students gave too much detail and attempted to provide all their knowledge for a single part.

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Question 1a.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 55 | 26 | 19 | 0.7 |

Ethanol levels rose as ethanol is a product of anaerobic respiration. Oxygen levels decreased as oxygen is required for aerobic respiration.

Cellular respiration was not a suitable term to use in the answer.

Question 1b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 21 | 24 | 56 | 1.4 |

Prediction: Increase

Explanation: CO₂ is a product of (one of)

- cellular respiration
- aerobic respiration
- anaerobic respiration.

Respiration alone was not awarded any marks.

Question 1ci.

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

Light-independent stage or Calvin (Benson) cycle

Many students initially gave the light-independent stage, but changed their answer to the light-dependent stage.

Question 1cii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 56 | 20 | 24 | 0.7 |

| Name of input | Role |
|---------------|---------------------------------|
| ATP | provides energy to form glucose |
| NADPH | carries hydrogen ions |

NAD was incorrect as it is a carrier molecule in cellular respiration and not in photosynthesis.

Question 2a.

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

Polymerise: Joining of tubulin dimers (the monomer) to create the protofilament (the polymer)

Question 2b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 34 | 23 | 44 | 1.1 |

Primary structure: the sequence of amino acids

Secondary structure: the coiled or pleated structure

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Question 2c.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 50 | 34 | 17 | 0.7 |

Tertiary structure: A 3D structure composed of secondary structures

Quaternary structure: Two or more polypeptide chains joined together

Rather than naming polypeptide chains for the quaternary structure, many students incorrectly mentioned proteins or tertiary structures being joined together.

Question 3a.

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

Hormone

Question 3b.

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

One of

- protein based
- hydrophilic
- polar.

Question 3ci.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 42 | 29 | 29 | 0.9 |

The binding triggers a range of events that carries the signal into the cell, such as the synthesis of a second messenger, and a cascade of events occurs.

Two separate points that related to the transduction of the signal into a cellular response were required.

Question 3cii.

| Marks | 0 | 1 | Average |
|-------|----|----|------------|
| % | 68 | 32 | 0.3 |

There may be different receptors or different secondary molecules.

Question 4a.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 49 | 35 | 16 | 0.7 |

Active protection: The child is producing its own antibodies and memory cells.

No mark was awarded for simply naming 'active protection'.

Question 4b.

| Marks | 0 | 1 | 2 | 3 | Average |
|-------|----|----|----|----|------------|
| % | 29 | 24 | 23 | 23 | 1.4 |

Step 2: T-helper cells produce cytokines to stimulate B cells.

Step 3: B cells differentiate to produce plasma cells, which produce specific antibodies.

Step 4: B cells also differentiate into memory cells.

The information was marked across all boxes; there were three marks available regardless of where the information appeared. The role of cytokines was poorly understood.

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Question 4c.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 37 | 37 | 26 | 0.9 |

How: to produce more memory B cells

Why: memory cells are short lived

The idea of a booster vaccination was confused with vaccinations, which require two or three doses of a vaccine to confer long-term immunity.

Question 5a.

| Marks | 0 | 1 | Average |
|-------|----|----|------------|
| % | 85 | 15 | 0.2 |

Autoantibodies attack self-cells and the destruction of this tissue leads to the symptoms of the disease.

Many students failed to relate the attack to the causing of the disease.

Question 5b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 49 | 28 | 22 | 0.8 |

The genetic screen indicates the potential to develop the disease and the absence of autoantibodies indicates that the disease has not yet been switched on.

Question 6ai.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 44 | 27 | 29 | 0.9 |

Both of

- DNA template strand is copied during transcription or RNA polymerase joins complementary nucleotides
- pre mRNA is formed.

Question 6aii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 32 | 12 | 56 | 1.3 |

Exons: are translated or are joined to form structure Q; mRNA

Introns: removed when splicing occurs

One mark was awarded if both parts were correctly named.

Question 6b.

| Marks | 0 | 1 | 2 | 3 | 4 | Average |
|-------|----|----|----|----|----|----------|
| % | 30 | 12 | 15 | 19 | 25 | 2 |

All of

- structure S (the ribosome) is where the mRNA is translated
- structure E (tRNA) transports a specific amino acid
- structure G anticodon, which is complementary to the codons of mRNA
- in structure F the product is a polypeptide.

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Question 7a.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 26 | 60 | 14 | 0.9 |

What event: mutation

Where: in the gametes of one of his parents

Most students recognised that a mutation had occurred. Many incorrectly thought that it occurred in I1 or did not make it clear where the mutation occurred.

Question 7b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 50 | 36 | 14 | 0.7 |

Dominant trait and two of

- all affected offspring have at least one affected parent
- present in every generation
- it is a rare condition and most unlikely that both parents are carriers.

The key information for this question was 'a rare autosomal genetic condition'.

Question 8a.

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

Sperm of a mouse: 20

Fertilised egg of a mouse: 40

Many students answered this question as though it were about humans, ignoring the reference to mice in the question stem.

Question 8b.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 45 | 39 | 16 | 0.7 |

Two of

- meiosis provides variation in offspring due to (one of): independent assortment or crossing over and recombination
- fertilisation results in increased variation through joining of gametes
- meiosis ensures gametes are haploid
- increases the chance of a species surviving if there are different selection pressures.

Question 8ci.

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

Linked genes are found on the same chromosome.

Students incorrectly stated that these genes were on the same chromatids.

Question 8cii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|------------|
| % | 36 | 11 | 54 | 1.2 |

Phenotype

Genotype

Black hair, short tail

BbSs

Black hair, long tail

Bbss

White hair, short tail

bbSs

White hair, long tail

bbss

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Students were awarded one mark for the correct phenotypes and one mark for the correct genotypes.

Question 8ciii.

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

Either of

- Yes. The same genotypes and phenotypes are possible if crossing over/recombination occurred
- No. Only two types of genotypes and phenotypes are produced, or the majority are of two types.

Students' answers were not always expressed clearly.

Question 9a.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 10 | 90 | 0.9 |

Extinction is when no members of a particular species exist.

Question 9bi.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 62 | 38 | 0.4 |

A gene pool is the complete set of alleles present in a population.

A wide variety of incorrect answers were given. A gene pool is not the genes present, nor the allele frequency. Many students defined the genome.

Question 9bii.

| | | | | |
|--------------|----------|----------|----------|----------------|
| Marks | 0 | 1 | 2 | Average |
| % | 35 | 42 | 23 | 0.9 |

Diversity produces a variety of phenotypes and there is an increased chance of survival of the population if the environment changes.

Some students stated that the genotype was selected for, which is incorrect.

Question 9c.

| | | | | |
|--------------|----------|----------|----------|----------------|
| Marks | 0 | 1 | 2 | Average |
| % | 47 | 33 | 20 | 0.8 |

Genetic drift: The change in allele frequency due to chance.

Bottleneck effect: A severe reduction in genetic diversity due to a catastrophe that may change allele frequency.

Many students gave incorrect examples of genetic drift, such as mutation. Others confused it with gene flow. The bottleneck effect was better explained by students.

Question 9d.

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

There were many suitable answers, including

- fencing to keep out predators
- maintaining suitable habitat
- culling of foxes.

The question asked for one further measure; however, some students repeated measures already given in the question.

Question 10a.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 65 | 35 | 0.4 |

The sequence of nucleotides or bases could be determined.

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Question 10b.

| | | | | |
|--------------|----------|----------|----------|----------------|
| Marks | 0 | 1 | 2 | Average |
| % | 43 | 46 | 11 | 0.7 |

Strains 2 and 3 have a more recent common ancestor and less time for nucleotide differences to appear.

The term 'most recent common ancestor' was also suitable; however, the 'most common' or 'recent' ancestor was not suitable.

Question 10c.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 69 | 31 | 0.3 |

The bats are the original source of the virus. The virus that infects palm civets and humans had a common ancestor.

Question 11a.

| | | | | | | |
|--------------|----------|----------|----------|----------|----------|----------------|
| Marks | 0 | 1 | 2 | 3 | 4 | Average |
| % | 6 | 11 | 25 | 31 | 27 | 2.6 |

| Feature | Description of difference | Significance of difference |
|-------------------------|---|---|
| pelvic structure | wider pelvic girdle in <i>A. africanus</i> than Neanderthal | harder to walk upright as tips centre of gravity in <i>A. africanus</i> |
| arm to leg length ratio | longer arm to leg ratio in <i>A. africanus</i> than Neanderthal | knuckle walking in <i>A. africanus</i> |

Question 11b.

| | | | | |
|--------------|----------|----------|----------|----------------|
| Marks | 0 | 1 | 2 | Average |
| % | 10 | 46 | 44 | 1.4 |

Use of sewing needles: construction of clothing enabling survival in harsh conditions
Division of labour between men and women: physically stronger males hunt

Many different answers also received the marks available.

Question 11c.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 66 | 34 | 0.4 |

Interbreeding occurred between Neanderthal and modern human populations.

A range of answers were accepted.

Question 12a.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 35 | 65 | 0.7 |

A genetically identical copy

Many students wrote too much for this answer and included incorrect information such as 'they have identical phenotypes' or 'they have the same genome' (all members of the same species have the same genome).

Question 12bi.

| | | | |
|--------------|----------|----------|----------------|
| Marks | 0 | 1 | Average |
| % | 40 | 60 | 0.6 |

To destroy the nucleus

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Question 12bii.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 37 | 18 | 45 | 1.1 |

Identical to Animal Y and there is no genetic material from X as the egg was enucleated

Question 12c.

| Marks | 0 | 1 | 2 | Average |
|-------|----|----|----|---------|
| % | 40 | 26 | 34 | 1 |

The hypothesis needed to be comparative and testable. For example, 'that a donor nucleus from an embryo forms clones more successfully than from an intestinal cell'.

Results: 23% success compared to 1.5%