



## GENERAL COMMENTS

This examination was the second for the reaccredited *Biology VCE Study Design*. The emphasis throughout the study design is on developing knowledge and understanding of the principles and concepts of biology and their application to a range of contexts. The major shift in content has been from a cellular focus to the current **molecular** focus.

Students' performance this year was most commendable. Where they were asked to use their own examples in responses, students showed a great depth of knowledge and a pleasing ability to apply key knowledge to the examination. Teachers and students are reminded that the set of key skills (on page 12 of the Study Design) are examinable.

Teachers and students are encouraged to visit the Biology study page on the VCAA website ([www.vcaa.vic.edu.au](http://www.vcaa.vic.edu.au)) to access resources provided to support VCE Biology. These resources are updated regularly and include opportunities for teacher professional development, student workshops, articles and relevant links.

## 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	% No Answer	Comments
1	15	3	73	9	0	
2	39	22	34	6	0	Drug 1 is in an area surrounded by the hydrophilic heads of the phospholipid bi layer, it is therefore lipophobic. Drug 2 is at the hydrophobic end of the phospholipid molecule and would not be water soluble. Therefore, options A and B cannot be correct.
3	10	59	14	17	0	
4	77	11	7	4	0	
5	9	8	79	4	0	
6	76	14	5	5	0	
7	10	17	24	49	0	
8	64	1	16	20	0	
9	7	73	9	11	0	
10	11	9	69	11	0	
11	5	15	12	68	0	
12	27	17	52	4	0	
13	6	11	49	34	0	
14	10	40	15	35	0	The chemical reaction shows how the bacteria obtain their energy, most probably in the form of ATP. The reaction is aerobic, requiring oxygen, exergonic, liberating energy and is not 100 per cent efficient, releasing some heat.
15	67	9	13	10	1	
16	56	16	14	14	0	
17	64	7	5	24	0	'D' is the correct answer; however, given the knowledge required of students in Unit 3, 'A' was also considered to be a reasonable deduction.
18	15	49	17	19	0	
Question	% A	% B	% C	% D	% No Answer	Comments
19	67	6	12	14	0	
20	8	6	10	77	0	
21	5	12	12	70	0	
22	11	65	12	13	0	
23	30	18	15	36	0	Both 'A' and 'D' were accepted as correct answers. It was a



						reasonable assumption that the methyl salicylate acts as a pheromone-like substance (though there is no term to describe these signalling molecules in plants). The substance acts the same way as a pheromone does for animals. It is obvious that the methyl salicylate produces a defensive response which may be to kill the pathogen; however, it may be that it prevents binary fission or some other process, but does not necessarily lead to death
24	1	3	14	81	0	
25	29	51	6	13	1	

## Section B – Extended response questions

The following areas caused some concern for assessors when marking the papers.

- Many students wrote their responses to this section in pencil, rather than in pen as instructed. Students should be aware that responses written in pencil can be very difficult for assessors to read; if an assessor cannot read the answer, no marks can be awarded.
- Many answers contained words that were spelt incorrectly. Although spelling and grammar are not assessed, students need to be aware that errors in spelling which lead to a lack of clarity in meaning can result in failure to gain credit for the answer. For example, words such as glycogen, glucagon and glucose may be indistinguishable if spelt incorrectly.
- There was some inappropriate use of abbreviations. Although well-known abbreviations such as DNA and ATP are acceptable, non-standard abbreviations should be avoided as they may be open to misinterpretation. Students are advised not to take short cuts that may result in marks not being awarded.

For each question in Section B, an outline or example of the correct answer(s) is provided. It is important to note that alternative wording of these answers could also have been awarded marks.

### Question 1

Parts of this question allowed students to draw on their own experience to provide suitable answers. As the question was relatively straightforward, it provided students with confidence to attempt the rest of Section B.

#### Question 1a.

Marks	0	1	Average
%	9	91	0.9

Pheromones

#### Questions 1b.

Marks	0	1	Average
%	43	57	0.6

The cell which responded had receptors specific for that particular hormone.

It was important that students made the link that receptors are specific; too often students used the term 'active site' to describe a receptor. Some students also incorrectly stated that the target (organ) lacked receptors, rather than relating their answer to the cell. These students were not awarded the mark.

#### Question 1c.

Marks	0	1	2	3	4	Average
%	14	10	28	27	21	2.4

A variety of hormones were provided in response to this question, and marks were awarded if the information given was correct.

It is important that students read the whole question before answering any part. In this question, many students realised part way through that, for the hormone given in part i., they were not able to give suitable answers to parts ii. and iv. It was disappointing that some students discussed plant hormones (plant growth regulator substances) when the question clearly asked for a hormone which travels through the blood. These students could not score for parts i., ii. or iv.

The table below lists some of the more common answers for parts i., ii. and iv. Part iv. specifically asked for an outcome at the cellular level, but many students failed to answer with reference to the cellular level.

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ci. Hormone	cii. Tissue or gland that produces the hormone	civ. Outcome in the target cells
Insulin	(Beta cells of) pancreas	Liver/skeletal muscles take up more glucose
Glucagon	(Alpha cells of) pancreas	Liver cells release glucose or break down glycogen
ADH	Hypothalamus	Cells in kidney tubule reabsorb more water

### ciii.

Signal transduction refers to the series of events that occur after the receipt of a specific signal and which result in a response.

This part was poorly answered. The concept of signal transduction underpins many of the processes discussed in Unit 3. It highlights, at the **molecular** level, the transfer of information from one form into another, which is then understood by the cell to produce a **response**. Many students failed to mention the generation of a response at the cellular level.

### Question 2

This question required students to recall definitions and apply knowledge based on the information provided.

#### Question 2a.

Marks	0	1	2	Average
%	22	38	40	<b>1.2</b>

#### ai.

Phagocytes are a type of lymphocyte which are able to:

- recognise, engulf and destroy foreign material such as pathogens
- engulf antibody-antigen complex
- display the antigens of ingested pathogens to trigger an immune response.

Any one of the above responses was acceptable.

#### aii.

Complement proteins:

- attach to invading micro-organisms
- make it easier for phagocytes to ingest
- lyse plasma membranes of pathogens, **not** cell walls
- promote inflammation.

Any one of the above responses was acceptable.

Part ii. was poorly answered. Many students incorrectly stated that complement proteins were cells; others gave varied, incorrect suggestions with no relevance to an immune response.

#### Question 2b.

Marks	0	1	2	Average
%	19	39	42	<b>1.3</b>

#### bi.

Cell R

#### bii.

Cell R has **more** non-self antigens than cells P or Q.

Many students incorrectly stated that cell R has more receptors. Careful reading of the information would have avoided this mistake. Students are advised that whenever a comparison is required, they need to make a comparative statement, rather than only mentioning one situation.

### Question 3

The standard of answers to this question showed a significant improvement on the quality of answers provided to similar questions in previous examinations.

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## Question 3a.

Marks	0	1	Average
%	30	70	0.7

Hydrogen peroxide

Many students did not seem to know what a substrate is and instead named the products, oxygen and water.

## Question 3b.

Marks	0	1	Average
%	34	66	0.7

Agree

- As the carrot grows at a soil temperature of 16°C, it would be expected that the carrot's catalase optimum temperature would be around this temperature, not 37°C as for humans.

Disagree

- It would be expected that the enzyme is the same in both organisms and would therefore have the same optimum temperature.

Either of the above answers was acceptable.

When responding to the question 'Do you agree or disagree?', some students incorrectly answered 'yes'. Students who did not clarify this ambiguous response elsewhere in their answer were not awarded the mark. An explanation was required to gain the mark.

## Question 3c.

Marks	0	1	2	3	Average
%	42	27	19	12	1.0

To gain three marks, the following points should have been included in students' responses.

- The use of at least two groups of identical pieces of carrot, placed at various temperatures (for example, 16°C and 37°C) in the same concentration of hydrogen peroxide. A specific number of carrot pieces could have been given (for example, 10). Students who mentioned the variable and other factors which were controlled adequately demonstrated their understanding of the experimental design and were awarded the first mark.
- For the second mark, students needed to discuss how catalase activity would have been measured. For example, collecting the gas to measure the production of oxygen gas, or observing the bubbles being produced.
- The third mark was awarded for a discussion of the expected results and a conclusion based on the student's prediction. For example, more oxygen gas produced at 16°C compared to 37°C would support the prediction that carrot catalase optimum temperature was 16°C.
- The idea of replicating the experiment could also have been mentioned.

If the experiment was feasible and followed correct experimental design, full marks were attainable. Common errors in the experiments described included growing carrots in hydrogen peroxide or adding catalase to the experiment. Some students failed to explain the results which would support or negate the student's prediction. Students must ensure that they answer all aspects of the question in order to gain full marks.

Experimental design is integral to science and this question exposed many deficiencies in students' knowledge and understanding of the process. Students need more practical experience with appropriate examples.

## Question 4

This question required students to have an understanding of the various stages of photosynthesis, in particular, the relationship between structure and function. Students demonstrated a good understanding of the structure of the chloroplast but some had trouble explaining the function.

## Question 4a.

Marks	0	1	Average
%	50	50	0.5

Part Y

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Name

- grana
- thylakoid
- stacks of grana or thylakoids

Some students correctly labelled all parts; however, they were not awarded the mark as the question specifically asked for the part which **absorbed the light**. As long as the word was not ambiguous, it was awarded the mark.

## Question 4b.

Marks	0	1	2	Average
%	45	23	32	<b>0.9</b>

Drawing B is from a plant living in a shaded rain forest as it has many more grana (as indicated by the information that there are dark green fronds) **and** this gives a greater ability to absorb any available light.

It is important that students always carefully read the information. Too often, students incorrectly stated that the diagrams indicated the presence of chloroplasts inside of the cell and did not realise the diagrams were of chloroplasts.

## Question 4c.

Marks	0	1	Average
%	63	37	<b>0.4</b>

Either of:

- osmosis (of water)
- diffusion (of water/carbon dioxide).

When students are asked to name something, it is important that they do so. It is not necessary to elaborate and students must be aware that if incorrect information is given in their elaboration, the mark cannot be awarded.

## Question 4d.

Marks	0	1	Average
%	76	24	<b>0.3</b>

Ribosomes synthesise protein to:

- produce the enzymes required for photosynthesis
- assist in the production of chlorophyll
- make the membranes of the chloroplast or within it.

Most students mentioned that ribosomes synthesise proteins; however, few could then relate this to their importance to the chloroplasts.

## Question 4e.

Marks	0	1	Average
%	81	19	<b>0.2</b>

Possible answers included:

- both contain DNA and are capable of self-replication
- both have ribosomes, which indicates they can make their own proteins
- both have a double membrane, one of the prokaryote and one of the host.

To gain the mark here, students had to give information that supported the endosymbiotic theory.

## Question 4f.

Marks	0	1	Average
%	57	43	<b>0.5</b>

Carbon dioxide

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## Question 4g.

Marks	0	1	Average
%	78	22	<b>0.2</b>

The source of these carriers is:

- the light dependent stage
- the electron transport chain of photosynthesis
- the splitting of water.

Any one of the above answers was acceptable.

## Question 4h.

Marks	0	1	Average
%	63	37	<b>0.4</b>

Glucose or water

Students who successfully answered this question were able to correctly apply their knowledge to the diagram. As stated in the stem, the diagram summarises the light-independent reaction. Some students obviously thought that the diagram was anaerobic respiration and hence pyruvate was a common incorrect answer for part h.

## Question 5

This question tested students' knowledge of the allergic response. Most students gained some marks in this question, with many gaining full marks. Students were able to interpret the diagrams and correctly apply their knowledge to the questions asked.

## Question 5a.

Marks	0	1	Average
%	33	67	<b>0.7</b>

Suitable allergens included:

- pollen
- food (for example, peanuts)
- dust mites.

Incorrect answers included food, with no example given, dust and fur. Some students named a condition caused by the allergen; for example, asthma or hay fever. They were not awarded the mark.

## Question 5b.

Marks	0	1	2	Average
%	28	35	37	<b>1.1</b>

bi.

Either of:

- rough endoplasmic reticulum
- ribosomes.

Students are advised that they should use the term 'rough endoplasmic reticulum' rather than non-standard abbreviations such as RER or Rough ER. Use of non-standard shortcuts may result in marks not being awarded.

bii.

The rough endoplasmic reticulum produces antibodies.

Many students made vague statements such as 'produce proteins', or incorrectly referred to Cell K; these students did not obtain the mark.

## Question 5c.

Marks	0	1	2	3	4	Average
%	18	18	20	23	20	<b>2.1</b>

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ci.

Either of:

- Mast Cell
- Basophil.

'Mask cell' was not awarded a mark.

cii.

Some suitable regions of the body are:

- skin, nose or connective tissue
- a specific organ of the digestive system (for example, the stomach)
- muscles in blood vessels.

Unacceptable answers included blood and muscles.

ciii.

Some suitable effects of the release of histamines included:

- swelling
- itching
- excessive mucus production
- constriction of airways.

civ.

Exocytosis

This was answered well. A common incorrect answer was secretion.

## Question 6

This question tested the molecular nature of biologically important compounds and was generally well answered.

Questions 6a. and 6c. should have referred to subunits of lipids rather than monomers. Special marking procedures were put in place to assess student responses to these questions; this included accepting as correct any indication in a student's response that there are 'no monomers of lipids'.

### Question 6a.

Marks	0	1	2	Average
%	25	59	16	0.9

Large molecule	Monomers/subunits
Protein (or a specific example such as haemoglobin)	Amino acids
Lipid	Fatty acids OR fatty acids and glycerol OR no monomer
Polysaccharide (or a specific example such as starch)	Monosaccharide
DNA	Nucleotides

Students were awarded two marks for four correct answers; one mark for two or three correct answers; and no marks if only one or no correct responses were given.

Carbohydrate was not an accepted answer for a polymer of monosaccharides, as a **large** molecule was asked for. Many students incorrectly gave 'nucleic acid' as the monomer of DNA.

### Question 6b.

Marks	0	1	Average
%	77	23	0.3

- A monosaccharide moves by facilitated diffusion **or** active transport.
- This occurs via protein channels **or** by protein carrier molecules.

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The process and structure were required to gain the mark. Many students incorrectly stated the process was endocytosis or that the passage occurred through the phospholipid bi layer.

## Question 6c.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
%	44	56	<b>0.6</b>

Any one of:

- as a component of plasma membrane
- as an energy source
- for energy storage.

Answers which suggested that there are 'no monomers of lipids' were also awarded the mark.

## Question 6d.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
%	21	79	<b>0.8</b>

<b>ATG</b>	<b>AAC</b>	<b>AGC</b>	<b>GGC</b>
TAC	TTG	TCG	CCG

Many careless mistakes were made in this question, such as leaving out one base or making an error in the use of complementary base pairing rules.

## Question 6e.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
%	34	66	<b>0.7</b>

Guanine

A common incorrect answer was glycine, taken from Question 7a.

## Question 7

Imprecise answers to this question cost many students marks.

## Question 7a.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
%	65	35	<b>0.4</b>

The detection of changes in the DNA could lead to:

- the cancer being treated **earlier**
- members of the family receiving advice to be tested
- a lifestyle change.

Any of the above answers was accepted. Too many students stated the cancer could be detected and made no mention of why this was an advantage. The knowledge gained by the change in the DNA had to be used to advantage.

## Question 7b.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>Average</b>
%	52	48	<b>0.5</b>

The doctor is not likely to be concerned as the change in the DNA produces the **same** amino acid sequence.

## Question 7c.

<b>Marks</b>	<b>0</b>	<b>1</b>	<b>2</b>	<b>Average</b>
%	61	17	23	<b>0.6</b>

Suitable applications of **molecular** biology in medicine included:

- design of a drug or vaccine which is specific to the target cell or which does not cause harm to healthy body cells or natural flora



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- gene therapy to alter or recognise particular DNA sequences and hence change the protein produced.

Specific names of drugs, such as Ralenza, could have been used and there were many suitable applications. Students who chose a cellular application, such as vaccination, or a technological application, such as electrophoresis, did not gain any marks unless they related their response to the **molecules** involved.

Some incorrect applications included IVF, stem cells, amniocentesis and synchrotron.

## Question 8

### Question 8a.

Marks	0	1	Average
%	68	32	<b>0.4</b>

Acceptable answers included:

- **intact** skin
- mucus
- stomach acid
- saliva
- tears.

Skin alone was not sufficient to gain the mark.

### Question 8b.

Marks	0	1	Average
%	69	31	<b>0.3</b>

Interferons are produced by viral infected cells and warn nearby cells and make them more resistant to infection **or** stimulate the production of antiviral proteins.

This part was poorly answered. Students appeared to have little knowledge of interferons; many described their role as that of complement proteins. Incorrect statements such as 'Interferons interfere with viruses' were common.

### Question 8c.

Marks	0	1	Average
%	76	24	<b>0.3</b>

The **lack of nucleic acid**; therefore the host cell cannot be programmed to replicate viruses.

Many students just reiterated the stem of the question and failed to relate their answer to preventing the disease. Other incorrect information given was that viruses are made of cells and are living.

### Question 8d.

Marks	0	1	Average
%	54	46	<b>0.5</b>

As a control to give a comparison to injecting the vaccine and to show that the response was due to the vaccine, not the saline.

Students who wrote 'as a control' or 'as a comparison', with no further information did not gain the mark. The key point of control is to make a valid comparison and to show that the variable is responsible for the result; in this case, it is the vaccine that led to the production of antibodies, **not** the saline.

### Question 8e.

Marks	0	1	2	Average
%	40	37	23	<b>0.9</b>

There is a delay in the production of antibodies as there must be recognition of the antigen and cloning of B cell. The second or subsequent response is greater and faster because of the presence of memory cells.

Many students failed to provide a sufficient explanation, instead simply repeating information that was given in the question, such as 'The response increases with each vaccination'.

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## Question 9

This question was not as well answered as expected. A lack of information in the answers often precluded awarding full marks.

### Question 9a.

Marks	0	1	2	Average
%	17	41	42	1.3

#### ai.

Any specific time between 4 and 5 pm was accepted.

Answers that did not specify 'pm' were not awarded the mark. Students needed to use a ruler to work out the approximate times on the graph for this and part ii.

#### aii.

No, the highest temperature during the day occurred prior to this at about 1.30 pm.

It was important to relate the answer to the highest air temperature, not to the activity of the lizard.

### Question 9b.

Marks	0	1	Average
%	63	37	0.4

The nervous system detects the skin temperature as there are receptors present **or** as it is a quick response.

It was not acceptable to state that sensory neurons detect the skin temperature; they convey the information. This part was not well answered. Many students scored zero as they incorrectly stated that it was the hormonal system and or involved the hypothalamus.