2016 Senior External Examination

Biology

Paper Two — Question and response book

Monday 7 November 2016
1 pm to 3:10 pm

Time allowed

- Perusal time: **10 minutes**
- Working time: **2 hours**

Examination materials provided

- Paper Two — Question and response book
- Notepaper

Equipment/materials allowed

- QCAA-approved equipment
- non-programmable calculator
- one A4 sheet of Evaluating biological issues (EBI) question topic research notes

Directions

Do not write in this book during perusal time.

Paper Two has **two** parts:

- Part A — Physiology of organisms
- Part B — Organisms and ecosystems

Attempt **all** questions.

Suggested time allocation

- Part A: 60 minutes
- Part B: 60 minutes

Assessment

Paper Two assesses the following assessment criteria:

- Understanding biology (UB)
- Investigating biology (IB)
- Evaluating biological issues (EBI)

Assessment standards are at the end of this book.

After the examination session

The supervisor will collect this book and your research notes when you leave.
Planning space
Part A — Physiology of organisms

Questions 1–9 assess Understanding biology (UB) or Investigating biology (IB).
Attempt all questions. Write your responses in the spaces provided.
Suggested time allocation: 60 minutes.

Question 1 (UB)

The diagram below shows the parts of a crocodile involved in breathing.

Crocodiles have lungs and breathe air but they lack a diaphragm. Crocodiles breathe in by expanding the ribs and contracting muscles attaching the liver to the hip bones. This pulls the liver back and causes air to enter the lungs. Breathing out occurs when the ribs are pushed inwards and contraction of the abdominal muscles moves the liver forward.

Explain the similarities and differences between crocodile and human respiratory systems.
Question 2 (UB)

The diagram below is of the human heart.

a. Use the letter/s on the diagram to indicate which vessel/s carry oxygenated blood.

b. If the muscular wall of the left ventricle thickens, the ventricle becomes stiff and is no longer able to pump the same amount of blood as it did under normal circumstances. This could lead to a heart attack.

Explain the effect on the blood pressure in:

i. the main artery of the arm.

ii. vessel D.
**Question 3 (UB)**

The diagram below shows the major structures of a section of the digestive system.

![Diagram of the digestive system](image.png)

**a.** Choose two of the structures shown in the diagram. Link each structure to its function in the digestive system.

- [ ]
- [ ]
- [ ]
- [ ]
- [ ]
- [ ]
- [ ]
- [ ]

**b.** Ingesting certain bacteria can lead to severe diarrhoea (watery faeces). Using your knowledge of how the digestive system functions:

- identify the organ being affected by the bacteria
- explain your reasoning.
Question 4 (IB)

The table below gives information about four species of birds in winter.

<table>
<thead>
<tr>
<th>Bird species</th>
<th>Body mass (g)</th>
<th>Energy needed per day (kJ)</th>
</tr>
</thead>
<tbody>
<tr>
<td>W</td>
<td>21</td>
<td>84.2</td>
</tr>
<tr>
<td>X</td>
<td>12</td>
<td>62.4</td>
</tr>
<tr>
<td>Y</td>
<td>9</td>
<td>49.5</td>
</tr>
<tr>
<td>Z</td>
<td>7</td>
<td>42.0</td>
</tr>
</tbody>
</table>

Interpret and analyse the data to draw a conclusion for the energy needed per day per gram of body mass. Use the data in your response.

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Question 5 (UB)

Consider the stimulus-response pathway that enables the body’s nervous system to detect and respond to changes in temperature.

Stimulus
↓
Receptor
↓
Control centre
↓
Effector
↓
Response

Use the terms in the stimulus-response pathway to explain how the body detects and responds to a decrease in environmental temperature.
Question 6 (UB)

Plants adapted to conditions of high temperatures and low water availability often have stomata sunken into pits on stems and leaves. The stomata remain closed during the hottest part of the day.

a. Describe the role of stomata in relation to gas exchange and water movement in plants.

b. Explain the role of stomata in water conservation for the plants during the hottest part of the day.

c. How would the closure of stomata affect the rate of photosynthesis and plant growth? Explain your response.

Question 7 (UB)

The following data was obtained by experiments measuring the transpiration from leaves and water absorption by the roots from soil in 100 plants over 2-hour periods starting from 12 noon. The plants were located in a glasshouse where humidity and temperature were maintained at constant levels.

<table>
<thead>
<tr>
<th>Process</th>
<th>2 pm</th>
<th>4 pm</th>
<th>6 pm</th>
<th>8 pm</th>
<th>10 pm</th>
<th>12 am</th>
<th>2 am</th>
<th>4 am</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transpiration from leaves (ml of water)</td>
<td>34</td>
<td>45</td>
<td>53</td>
<td>47</td>
<td>27</td>
<td>15</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>Absorption of water by roots (ml of water)</td>
<td>20</td>
<td>31</td>
<td>42</td>
<td>48</td>
<td>35</td>
<td>23</td>
<td>16</td>
<td>11</td>
</tr>
</tbody>
</table>
a. On the same set of axes, use the data to plot two graphs: one for transpiration, the other for absorption.

b. Interpret and analyse the results to draw a conclusion about the relationship between transpiration and absorption. In your response:
   i. describe and explain the pattern for transpiration and absorption.
   ii. explain why transpiration and absorption of water follows these patterns. Use theory in your explanation.
   iii. draw a conclusion about the relationship.
**Question 8 (UB)**

An athlete can run a marathon in 2 hours 15 minutes on a dry day in temperatures of up to 35 °C.

The athlete notices:

- if the air is dry, their body will not overheat
- in humid conditions, if the outside temperature is over 18 °C, their body will overheat.

Explain why the athlete overheats in humid conditions.

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Question 9 (IB)

Gardening books advise against growing broad beans and onions alongside each other as the growth of both crops is reduced.

You have a supply of onion root extract. Design an experiment to test the hypothesis that the extract is responsible for inhibiting the growth of the broad bean plants. In your design:

- provide methodology
- address variables
- plan replicate treatments
- identify data to be collected.

End of Part A
Part B — Organisms and ecosystems

Questions 1–4 assess Understanding biology (UB) and/or Investigating biology (IB).
Question 5 assesses Evaluating biological issues (EBI).
Attempt all questions. Write your responses in the spaces provided.
Suggested time allocation: 60 minutes.

**Question 1 (IB)**

At the seashore, the tide comes in and goes out twice each day. Some students investigated whether two different species of seaweed — bladder wrack and sea lettuce — could live only at certain positions on a rocky shore. Seaweeds are plant-like organisms that make their food by photosynthesis.

The students:

1. placed a 50-metre tape measure on the rocks at right angles to the sea.
2. placed a 1 m x 1 m quadrat next to the tape measure.
3. recorded whether each species was present or not.
4. repeated steps 2 and 3 every metre down the shore.

The section of the seashore and the results are shown below.

a. The students placed the quadrat at regular intervals along the transect line rather than placing the quadrat at random positions anywhere on the rocky shore. Explain why this is a better method.

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b. Analyse the data to draw a conclusion about the distribution of bladder wrack and sea lettuce. Use the data in your response.

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c. How could the students have improved their investigation?

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Question 2 (UB)

Locust plagues are common in some inland areas of Australia following seasons of good rainfall. Locusts feed on a variety of crops and pastures, invading previously uninfested areas.

a. Describe the short-term effect/s the locust plague would have on the ecosystem.

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b. Explain the long-term effect/s on the ecosystem.

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**Question 3 (UB)**

Define the following and give an example for each.

a. Parasitism

b. Mutualism

**Question 4 (UB and IB)**

a. Draw a food web for the ecosystem described below.

In a particular forest ecosystem, leaf-eating insects feed on the leaves of Eucalyptus trees, while sap-sucking insects feed on the sap of these trees. Starlings eat both types of insects, and these birds are in turn preyed upon by goshawks. Spiders that live in the trees feed on wasps and the leaf-eating and sap-sucking insects. Wasps are sometimes observed eating the sap-sucking insects.

b. Add a decomposer organism to your food web, including appropriate arrows.
Question 5 assesses Evaluating biological issues (EBI). Write an extended response below.

Your response MUST refer to biological principles, concepts and ideas.

**Question 5 (EBI)**

Australia’s biodiversity has been under threat ever since European settlement with 24 mammals becoming extinct since the late 18th century. Feral cats are one of the major causes of extinctions. They are found across Australia and kill tens of millions of native animals every night. A long-term sustainable solution is needed.

Decide if dingoes should be introduced into areas to keep feral cat numbers down. In your response, explain the:

- effects of feral cats on the ecosystem.
- advantages and disadvantages of introducing dingoes.

Justify your decision by referring to the advantages and disadvantages discussed.

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End of Part B

End of Paper Two
Planning space
Planning space
Planning space
### Assessment standards derived from the Biology Senior External Syllabus 2006

#### Paper Two

<table>
<thead>
<tr>
<th>Criterion</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Understanding biology (UB)</strong></td>
<td>The candidate communicates understanding by:</td>
<td>The candidate communicates understanding by:</td>
<td>The candidate communicates understanding by:</td>
<td>The candidate communicates understanding by:</td>
<td>The candidate states terminology and ideas relevant to concepts.</td>
</tr>
<tr>
<td></td>
<td>• making links between related ideas, concepts, principles</td>
<td>• explaining ideas, concepts, principles and theories and</td>
<td>• defining and describing ideas, concepts, principles and theories, and identifying interrelationships between them</td>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>and theories to reveal meaningful interrelationships</td>
<td>describing interrelationships between them</td>
<td>and identifying interrelationships</td>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
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<td></td>
<td>• applying knowledge and understanding to a range of complex and</td>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
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<tr>
<td><em>Investigating biology (IB)</em></td>
<td>The candidate communicates investigative processes by:</td>
<td>The candidate communicates investigative processes by:</td>
<td>The candidate communicates investigative processes by:</td>
<td>The candidate communicates investigative processes by:</td>
<td>The candidate communicates investigative processes by providing incomplete methodology.</td>
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<td></td>
<td>• designing an investigation by providing methodology, addressing</td>
<td>• design an investigation by providing methodology, addressing</td>
<td>• designing an investigation by providing incomplete methodology with few variables and attempts to include a control</td>
<td>• using data to draw conclusions.</td>
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<td>obvious variables and control, planning replicate treatments and</td>
<td>obvious variables and control and planning replicate treatments</td>
<td>• designing an investigation which provides incomplete methodology and mentions variables.</td>
<td>• using data to answer questions</td>
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<td></td>
<td>identifying data to be collected</td>
<td>• interpreting data and drawing conclusions relating to the</td>
<td>• interpreting and critically analysing data with links to</td>
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<tr>
<td></td>
<td>• interpreting and critically analysing data with links to the</td>
<td>question/s.</td>
<td>theoretical concepts to draw conclusions relating to the</td>
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<td></td>
<td>question/s.</td>
<td></td>
<td>question/s.</td>
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<tr>
<td>**Evaluating biological issues</td>
<td>The candidate communicates by integrating the information and</td>
<td>The candidate communicates by integrating the information and</td>
<td>The candidate communicates by selecting relevant information</td>
<td>The candidate communicates by making unsupported decisions.</td>
<td>The candidate communicates by restating supplied information.</td>
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<tr>
<td>(EBI)</td>
<td>data to make justified and responsible decisions.</td>
<td>data to make logical decisions.</td>
<td>and data to make plausible decisions and predictions.</td>
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