2010 Senior External Examination

Biology
Paper One — Question and response book

Time allowed
- Perusal time: 10 minutes
- Working time: 2 hours 30 minutes

Examination materials provided
- Paper One — Question and response book
- Notepaper

Equipment allowed
- QSA-approved equipment
- non-programmable calculator

Directions
Do not write in this book during perusal time.

Paper One has three parts:
- Part A — Cell structure and function
- Part B — Physiology of organisms
- Part C — Organisms and ecosystems

Suggested time allocation
- Part A: 50 minutes
- Part B: 50 minutes
- Part C: 50 minutes

Assessment
Assessment standards are at the end of this book.

After the examination session
The supervisor will collect this book when you leave.
Planning space
Part A — Cell structure and function

Section 1 — Short response

Section 1 has 10 questions that assess Understanding biology (UB) and Investigating biology (IB). Attempt all questions. Respond to the questions in the spaces provided.

Question 1 (UB)

Using scientific conventions, draw and label a diagram of a plant cell showing three structures that are used to classify it as a plant rather than any other cell type.

---

Question 2 (UB)

a. Below is a section of the plasma membrane of an animal cell. Label any three components on the diagram.

b. Link the structure of the membrane to its function.
**Question 3 (UB)**

Explain how the role of the Golgi apparatus and the rough endoplasmic reticulum are related.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

**Question 4 (UB)**

Define translocation in plants.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................

**Question 5 (UB)**

Draw a labelled diagram to show the process of mitosis in an animal cell with two chromosomes.
Question 6 (UB)
Explain, using examples, the difference between osmosis and diffusion.
Hint: a diagram may be useful.

Question 7 (UB)
Choose a substance that moves across cell membranes by active transport. Explain the process involved.

Question 8 (UB)
Explain why the statement below is false.
“Light-independent reactions occur in mitochondria whether light is present or not.”
Question 9 (IB)

The aim of an experiment is to demonstrate the benefits of plant cells having a cell wall when investigating the process of osmosis.

a. Formulate and justify a hypothesis.

b. Design an experiment to test the hypothesis.

c. Evaluate how the method will test the hypothesis.
**Question 10 (IB)**

Many types of fruits and vegetables go brown when cut owing to an enzyme that produces a brown-coloured antiseptic, which protects the cut section of the fruit from disease. In an experiment to investigate the action of this enzyme, puréed potatoes were filtered to extract the enzymes. The filtrate was then kept in an ice bath. The filtrate was poured into test tubes and then placed in an incubator at 37°C for 10 minutes.

a. Complete the table with your prediction of what would be seen in each test tube.

<table>
<thead>
<tr>
<th>Test tube</th>
<th>Substrate (mL)</th>
<th>Enzyme extract (mL)</th>
<th>Distilled water (mL)</th>
<th>Predicted observations</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td></td>
</tr>
</tbody>
</table>

b. Explain the predicted results.

End of Section 1
Section 2 — Extended response

Section 2 has two questions that assess Evaluating biological issues (EBI). Write an extended response to one of the questions below.

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

Plan your response carefully. If you do a first draft and then a final draft, indicate which is the draft to be assessed.

Either

Question 1 (EBI)

Plant tissue culture is a practice used to propagate plants under sterile conditions to produce clones of a plant. These procedures rely on the fact that many plant cells have the ability to regenerate a whole plant. Single cells, plant cells without cell walls, pieces of leaves or roots can often be used to generate a new plant on culture media given the required nutrients and plant hormones.

Discuss the potential effects of overuse of plant tissue culture technologies.

or

Question 2 (EBI)

Drugs affect cell processes in a wide variety of ways. From pharmaceutical benefits to performance-enhancing impacts, drugs can be used in the human body to impact on basic body processes.

Critically evaluate the role of drugs used, and the potential long-term impact that this may have on the ability of the human body to protect and repair itself.

Tick the question you have chosen: 1 2
End of Section 2

End of Part A
Part B — Physiology of organisms

Section 1 — Short response

Section 1 has seven questions that assess *Understanding biology* (UB) and *Investigating biology* (IB). Attempt all questions.

Respond to the questions in the spaces provided.

**Question 1 (UB)**

Compare and contrast the concentration of substances in the renal arteries with those in renal veins.

.............................................................................................................
.............................................................................................................
.............................................................................................................
.............................................................................................................
.............................................................................................................
.............................................................................................................

**Question 2 (UB)**

Draw a diagram to explain the process of transpiration in a plant.
Question 3 (UB)

Air conditioners used in most homes and businesses across Australia are thermo-regulated. The human body is thermo-regulated for the homeostasis of temperature.

a. Predict the possible effect on the sensory systems that deliver information to the human brain if a person were to stay in air-conditioned rooms for their entire life.

..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................

b. Contrast this with people who frequently move in and out of air-conditioned buildings, such as delivery truck drivers.

..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................

Question 4 (UB)

The control of temperature and the control of carbon dioxide concentration in blood and tissues take place by a similar mechanism. Briefly explain one difference between the two control systems.

..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................

Question 5 (UB)

In the human body, the rate of diffusion of a substance across a membrane can be sped up. State two factors that would contribute in this way, and explain why.

..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................
..........................................................................................................

.............................................................................................................
Question 6 (IB)

a. An experiment was designed to investigate how transpiration rates vary with different environmental conditions. Identify the dependent and independent variables.

<table>
<thead>
<tr>
<th>Dependent</th>
<th>Independent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

b. State the control.

Question 7 (IB)

This table shows the percentages of gases in inhaled and exhaled air in humans.

<table>
<thead>
<tr>
<th>Gas</th>
<th>Inhaled air (% volume)</th>
<th>Exhaled air (% volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>20.95</td>
<td>16.40</td>
</tr>
<tr>
<td>Carbon dioxide</td>
<td>0.04</td>
<td>4.10</td>
</tr>
<tr>
<td>Nitrogen</td>
<td>79.01</td>
<td>79.50</td>
</tr>
<tr>
<td>Water</td>
<td>humidity dependent</td>
<td>saturated</td>
</tr>
</tbody>
</table>

Compare the quantities of gases in the inhaled and exhaled air. Interpret the data based on your understanding of respiration to determine any links that appear to exist between gases. Suggest a reason for this.

End of Section 1
Section 2 — Extended response

Section 2 has two questions that assess Evaluating biological issues (EBI). Write an extended response to one of the questions below.

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

Plan your response carefully. If you do a first draft and then a final draft, indicate which is the draft to be assessed.

Either

Question 1 (EBI)

Lifestyle “diseases” such as atherosclerosis, lung cancer, type 2 diabetes and obesity appear to increase in frequency as countries become more industrialised and people live longer.

Choose a lifestyle disease, discuss why it may have become more prevalent in the past 50 years, and predict how this is likely to change in the next 50 years. In your response, focus on the biological causes of the disease.

or

Question 2 (EBI)

In 2009, large numbers of people were quarantined worldwide in response to deaths from H1N1 influenza (human swine flu). In today’s global environment, diseases have the potential to spread across the world in a matter of days, or even hours, making early detection and action more important than ever. A critical role in disease management is the investigating, monitoring and controlling of diseases.

Justify the existence of an organisation that would coordinate government responses on a global scale to pandemics such as the human swine flu.

Tick the question you have chosen: 1 2
Section 1 — Short response

Section 1 has eight questions that assess Understanding biology (UB) and Investigating biology (IB). Attempt all questions.
Respond to the questions in the spaces provided.

Question 1 (UB)
Coral polyps often contain algae living within their tissues, which contribute to their spectacular colours. The algae generally do not survive outside the polyp and the coral grows more slowly if the algae are not present. State the name of this biological association.

Question 2 (UB)
Explain the difference between primary and secondary succession using specific examples.

Question 3 (UB)
Choose an organism. Explain how it is behaviourally, structurally or physiologically adapted to its natural environment.
Question 4 (UB)

Explain how eutrophication affects the organisms in a river system.

...............................................................................................................
...............................................................................................................
...............................................................................................................
...............................................................................................................
...............................................................................................................

Question 5 (UB)

Draw a labelled diagram of the carbon cycle that includes the following terms:

- respiration
- atmospheric carbon dioxide
- burning fossil fuel
- biomass.
Question 6 (IB)

During a field investigation at a woodland ecosystem, a student noticed that slaters (a terrestrial crustacean easily recognised by their armoured, flattened bodies which are often a greyish pink colour) appeared to be most abundant in moist dark conditions where humus was plentiful. Formulate a hypothesis that explains the distribution of slaters.

...............................................................................................................
...............................................................................................................
...............................................................................................................
...............................................................................................................
...............................................................................................................
...............................................................................................................

Question 7 (IB)

The table below shows figures relating to the recycling of plant biomass in two different ecosystems.

<table>
<thead>
<tr>
<th></th>
<th>Living plant biomass (kg/m²)</th>
<th>New plant material per year (kg/m²)</th>
<th>Organic matter in soil (kg/m²)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deciduous woodland</td>
<td>40.7</td>
<td>0.8</td>
<td>1.4</td>
</tr>
<tr>
<td>Tropical rainforest</td>
<td>52.5</td>
<td>3.3</td>
<td>0.3</td>
</tr>
</tbody>
</table>

Use the data to demonstrate why the deforestation of rainforests has more of a long-term impact than the deforestation of deciduous woodlands.
**Question 8 (IB)**

Draw a completed quadrat of a hypothetical 10 m x 10 m study area. Include a key for the species of plants that may have been found there, and are included in your field sketch. Place a transect line through the centre of the sketched quadrat. From this, create a diagram of the representative transect profile.

<table>
<thead>
<tr>
<th>Quadrat field sketch</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transect profile</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

Briefly discuss how this data could be used when examining ecosystems.

...............................................................................................................

...............................................................................................................

...............................................................................................................

**End of Section 1**
Section 2 — Extended response

Section 2 has two questions that assess Evaluating biological issues (EBI). Write an extended response to one of the questions below.

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

Plan your response carefully. If you do a first draft and then a final draft, indicate which is the draft to be assessed.

Either

**Question 1 (EBI)**

Biodiversity refers to the variation of life forms within a given ecosystem, biome or for the entire planet. Biodiversity is often used as a measure of the health of biological systems. The biodiversity found on Earth today consists of many millions of distinct biological species. Many factors lead to a loss of biodiversity, such as the clearing of native vegetation, illegal trade of wildlife, pollution and introduced predators and pathogens.

Critically evaluate the effect of reducing the Earth’s biodiversity at a faster rate than it can be restored. Justify ways that this could be rectified.

or

**Question 2 (EBI)**

Reclaiming land that was once mangroves and swamps is becoming increasingly common as the human population expands and urban areas encroach on natural ecosystems.

Justify the legislated protection of these areas from further development, and evaluate the advantages and disadvantages of restoring reclaimed areas to their natural state.

Tick the question you have chosen: 1  2
End of Section 2

End of Part C

End of Paper One
Planning space
Planning space
### Assessment standards from the 2006 senior external syllabus for Biology

<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</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 stating ideas and using terminology relevant to concepts and recalling interrelationships.</td>
<td>The candidate states terminology and ideas relevant to concepts.</td>
</tr>
<tr>
<td></td>
<td>• making links between related ideas, concepts, principles and theories to reveal meaningful interrelationships</td>
<td>• explaining ideas, concepts, principles and theories and describing interrelationships between them</td>
<td>• applying knowledge and understanding to a range of complex and challenging tasks.</td>
<td>• defining and describing ideas, concepts, principles and theories, and identifying interrelationships</td>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
</tr>
<tr>
<td></td>
<td>• applying knowledge and understanding to a range of complex and challenging 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>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
<td>• applying knowledge and understanding to a range of complex tasks.</td>
</tr>
<tr>
<td><strong>Investigating biology</strong></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:</td>
</tr>
<tr>
<td></td>
<td>• formulating justified researchable questions</td>
<td>• formulating researchable questions</td>
<td>• identifying researchable questions</td>
<td>• using data to answer questions</td>
<td>• providing incomplete methodology, and transcribes data.</td>
</tr>
<tr>
<td></td>
<td>• designing an investigation by providing methodology, addressing variables and control, planning replicate treatments and identifying data to be collected</td>
<td>• designing an investigation by providing methodology, addressing obvious variables and control and planning replicate treatments</td>
<td>• designing an investigation by providing incomplete methodology with few variables and attempts to include a control</td>
<td>• designing an investigation which provides incomplete methodology and mentions variables</td>
<td>• attempting to organise data.</td>
</tr>
<tr>
<td></td>
<td>• organising data to identify trends and interrelationships</td>
<td>• organising data</td>
<td>• interpreting data and drawing conclusions relating to the question(s)</td>
<td>• using data to draw conclusions.</td>
<td>• attempting to organise data.</td>
</tr>
<tr>
<td></td>
<td>• interpreting and critically analysing data with links to theoretical concepts to draw conclusions relating to the question(s)</td>
<td>• interpreting data and drawing conclusions relating to the question(s)</td>
<td>• evaluating the design of the investigation and the adequacy of the data collected.</td>
<td>• using data to draw conclusions.</td>
<td>• attempting to organise data.</td>
</tr>
<tr>
<td></td>
<td>• evaluating the design of the investigation and reflecting on the adequacy of the data collected and proposing refinements.</td>
<td>• evaluating the design of the investigation and reflecting on the adequacy of the data collected.</td>
<td>• evaluating the design of the investigation and the adequacy of the data collected.</td>
<td>• evaluating the design of the investigation and the adequacy of the data collected.</td>
<td>• evaluating the design of the investigation and the adequacy of the data collected.</td>
</tr>
<tr>
<td>Criterion</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------</td>
</tr>
<tr>
<td>Evaluating biological issues</td>
<td>The candidate communicates by:</td>
<td>The candidate communicates by:</td>
<td>The candidate communicates by:</td>
<td>The candidate communicates by:</td>
<td>The candidate communicates by:</td>
</tr>
<tr>
<td></td>
<td>• critically analysing and evaluating information and data from a</td>
<td>• analysing and evaluating information and data from a variety of</td>
<td>• analysing information and data from a variety of sources to</td>
<td>• making statements related to source material</td>
<td>• restating supplied information.</td>
</tr>
<tr>
<td></td>
<td>variety of sources to determine validity, reliability and bias</td>
<td>variety of sources to determine validity, reliability and bias</td>
<td>determine validity, reliability and bias</td>
<td>• making unsupported decisions</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• integrating the information and data to make justified and</td>
<td>• integrating the information and data to make logical decisions</td>
<td>• selecting relevant information and data to make plausible</td>
<td>• recognising that a given issue has biological implications.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>responsible decisions</td>
<td>• recognising alternatives and predictions that are relevant in</td>
<td>decisions and predictions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• comparing alternatives and predictions relevant in past,</td>
<td>a range of past and present biological contexts.</td>
<td>• recognising concepts that form the basis of present-day</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>present and future biological contexts.</td>
<td></td>
<td>biological issues in a range of biological contexts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>