Time allowed
• Perusal time: 10 minutes
• Working time: 2 hours

Examination materials provided
• Paper Two – Question and response book
• Notepaper

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

Directions
Do not write in this book during perusal time.
Paper Two has two parts:
• Part A: Short response
• Part B: Extended response
Attempt all questions.

Suggested time allocation
• Part A: 45 minutes
• Part B: 1 hour 15 minutes

Assessment
Assessment standards are at the end of this book.

After the examination
The supervisor will collect this book when you leave the examination room.
Planning space
Part A

Short response

Suggested time allocation: **45 minutes**.

This part has **25** questions of equal value. Attempt **all** questions.

Part A assesses *Understanding Biology* (UB) and *Investigating Biology* (IB).

Respond to the questions in the spaces provided.

Questions 1 to 15 assess *Understanding Biology* (UB).

**Question 1**

State the name of the complex molecule from which energy for a cell’s use is released.

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

**Question 2**

State one function of the endoplasmic reticulum in cellular function.

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

**Question 3**

Explain why the DNA molecule replicates itself during cell division.

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

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

**Question 4**

Describe one function of the small intestine.

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

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

**Question 5**

Briefly describe how a foetus receives nutrition during its development in the womb.

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

.................................................................................................................
Question 6
In the space below, draw a series of diagrams to show the process of phagocytosis.

Question 7
Where an injury occurs, pus (thick yellow fluid) may accumulate. Describe what pus consists of.

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

Question 8
Briefly describe, using an example, one way in which a new species could be formed.

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

Question 9
A grasshopper zygote has 30 chromosomes. How many chromosomes are in a grasshopper muscle cell? Explain your reasoning.

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

Question 10
In Drosophila (fruit flies), sex is inherited in a similar way to humans. The wild-type body colour is sex-linked and dominant to the yellow body colour. State the ratio of the phenotypes resulting from a wild-type male crossed with a yellow female. Show your working.
Question 11

A DNA segment has this nucleotide sequence:
A A G C T C T T

List the mRNA sequence that is complementary to this sequence.

Question 12

Explain mutualism, using an example.

Question 13

The table below shows the characteristics of five plant species.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Habitat</td>
<td>aquatic</td>
<td>land</td>
<td>land</td>
<td>land</td>
<td>aquatic</td>
</tr>
<tr>
<td>Produces flowers</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Produces cones</td>
<td>X</td>
<td>✓</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Produces seeds</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Produces own food</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>✓</td>
</tr>
<tr>
<td>Has vascular tissue</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

Decide which two of the species described above could be included in the plant group known as angiosperm.

Question 14

State the level of taxonomy at which the greatest degree of similarity between two organisms is found.

Question 15

Many chemical reactions in living organisms depend upon an exact binding between two molecules. The action of enzymes is an example. Explain the role of an enzyme.

**Question 16**

A scientist is comparing the density of water fleas in two different environments. For each environment, she collects five samples of 100 ml and counts the number of water fleas present in each sample.

<table>
<thead>
<tr>
<th>Sample number</th>
<th>Pond</th>
<th>Stream</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>2</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>4</td>
<td>14</td>
<td>8</td>
</tr>
<tr>
<td>5</td>
<td>5</td>
<td>3</td>
</tr>
</tbody>
</table>

Compare the density of water fleas in the two environments. State a possible reason for these results.

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

**Question 17**

The graph below shows world human population changes.

![Graph showing world human population changes](image)

In what 100-year period was the greatest increase in the world’s human population? Provide a possible biological reason for this increase.

........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
........................................................................................................................................
Question 18

The table below shows plant and animal counts for the years 1985 to 1990 in a small area. The counts include all of the plants in the area.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant 1</td>
<td>10</td>
<td>79</td>
<td>95</td>
<td>35</td>
<td>15</td>
<td>0</td>
</tr>
<tr>
<td>Plant 2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>20</td>
</tr>
<tr>
<td>Plant 3</td>
<td>80</td>
<td>62</td>
<td>23</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Plant 4</td>
<td>20</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Plant 5</td>
<td>0</td>
<td>5</td>
<td>20</td>
<td>95</td>
<td>110</td>
<td>50</td>
</tr>
<tr>
<td>Animal A</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Animal B</td>
<td>12</td>
<td>10</td>
<td>7</td>
<td>8</td>
<td>9</td>
<td>10</td>
</tr>
<tr>
<td>Animal C</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td>25</td>
<td>16</td>
</tr>
</tbody>
</table>

State the most probable food for Animal C. Justify your response.

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

Question 19

Two pumpkins are growing on the same plant. At the start of their development, one was enclosed in an aluminium foil bag and the other enclosed in a clear plastic bag. Both bags allowed the passage of oxygen, carbon dioxide and water. The mass of the pumpkins was measured with the results recorded below.

<table>
<thead>
<tr>
<th>Type of enclosure</th>
<th>Pumpkin mass</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Start of experiment</td>
</tr>
<tr>
<td>Aluminium foil</td>
<td>5 g</td>
</tr>
<tr>
<td>Clear plastic</td>
<td>5 g</td>
</tr>
</tbody>
</table>

Suggest possible improvements to the experiment.

...............................................................................................................
...............................................................................................................
..............................................................................................................
Question 20

The table below shows the fitness levels of men.

<table>
<thead>
<tr>
<th>Fitness level</th>
<th>Under 30 yrs of age</th>
<th>30–39 yrs old</th>
<th>40–49 yrs old</th>
<th>50+ yrs old</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very poor</td>
<td>&lt;1.6km</td>
<td>&lt;1.5km</td>
<td>&lt;1.4km</td>
<td>&lt;1.3km</td>
</tr>
<tr>
<td>Poor</td>
<td>1.6–2.0</td>
<td>1.5–1.8</td>
<td>1.4–1.7</td>
<td>1.3–1.6</td>
</tr>
<tr>
<td>Fair</td>
<td>2.0–2.4</td>
<td>1.8–2.2</td>
<td>1.7–2.0</td>
<td>1.6–2.0</td>
</tr>
<tr>
<td>Good</td>
<td>2.4–2.8</td>
<td>2.25–2.6</td>
<td>2.0–2.5</td>
<td>2.0–2.4</td>
</tr>
<tr>
<td>Excellent</td>
<td>2.8+</td>
<td>2.6+</td>
<td>2.5+</td>
<td>2.4+</td>
</tr>
</tbody>
</table>

How fit does a 50-year-old man have to be to run farther than a 29-year-old man? Explain your response.

Question 21

The graph below shows the blood flow through various organs during strenuous exercise and at rest.

Analyse the data and explain the effect of exercise on the body’s organs.

Analyse the data and explain the effect of exercise on the body’s organs.
Question 22

John is married to Margaret and they have three children, David, Alison and Jane. David is married to Claire. Their daughter Natalie has two brothers, Daniel and Justin. Gemma and Donna are twins. The mother of Gemma and Donna is Alison and the father is Robert.

Design a pedigree with a key. Use correct biological protocols for this family.

Question 23

Briefly describe an experimental investigation you have undertaken during your study of biology. Suggest valid improvements that could be made on the investigation design.
Question 24

State the difference between primary data and secondary data using examples that you have been exposed to during your study of biology.

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

Question 25

Design an experiment to investigate one aspect of plant physiology. Justify the variables involved. Include methodology, the type of results to be gathered and a prediction of how results would be analysed.

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

End of Part A
Part B

Extended response

Suggested time allocation: 1 hour 15 minutes.
This part has three questions of equal value. Attempt all questions.
Part B assesses Evaluating Biological Issues (EBI).
Write an extended response to each of the questions on the following pages.
Each response must refer to biological principles, concepts and ideas.
Plan your responses carefully. If you do a first draft and then a final draft, indicate which is the draft to be assessed.
Additional lined pages for responses, if required, are on pages 16–19. If you use the additional pages, label the question you are responding to in the box provided on each page.

Question 1

There have been over 700 recorded shark attacks in Australia in the past 200 years, with nearly 200 of them fatal. Although shark numbers are diminishing worldwide, the populations of some species are on the rise in Australian waters. For example, great white sharks are moving closer to shore because of dwindling fish stocks. Recently, there has been an increase in shark attacks on humans in populated areas. Some community groups are calling for large-scale shark hunting to be carried out to protect the human population. Evaluate the validity of this proposal, and predict the impact on both the overall shark population and other organisms, including humans, if this is allowed to occur.
Question 2

Fishing for mud crabs is a popular activity in Australia, both recreationally and commercially. Wire-framed cages are baited with meat and immersed in sea water. They are constructed to allow the crabs to climb in but be unable to get out, allowing them to be harvested. In Queensland, legislation states that all female crabs must be returned to the water. The minimum legal size for male crabs to be harvested is 15 cm measured across the widest part of the body. Crabs reproduce rapidly, have a protracted spawning period, grow rapidly and reach sexual maturity early. These are traits that make them resilient to fishing pressure. However, it is getting harder to find male crabs above legal size while female crab numbers are increasing. It is also observed that large females are often overly aggressive towards smaller male crabs. Predict the effects this may have on the future of crabpot harvesting.
Question 3

Antibiotic resistance is the ability of a microorganism to withstand the effects of antibiotics. Antibiotic resistance typically evolves via natural selection acting upon random mutation. If a bacterium carries several resistance genes, it is called multi-resistant or, informally, a superbug. People who are ill and prescribed antibiotics are usually directed by their medical practitioner to complete the entire course of antibiotics. Those who don’t are said to increase the possibility of the emergence of more “superbugs”. Critically analyse the risks and benefits of the use of antibiotics. Consider the following issues:

• not taking any drugs at all
• taking part of a prescribed course of antibiotics
• completing the prescribed course of antibiotics
• the over-prescription of antibiotics.
<table>
<thead>
<tr>
<th>Part B</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Part B</td>
<td>Question</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
</tr>
</tbody>
</table>

...
Planning space
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</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>biology</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></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></td>
</tr>
<tr>
<td><strong>Investigating</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>biology</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></td>
</tr>
<tr>
<td></td>
<td>• organising data to identify trends and interrelationships</td>
<td>• organising data</td>
<td>• organising data</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>• interpreting data and drawing conclusions relating to the question(s)</td>
<td>• using data to draw conclusions.</td>
<td></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></td>
</tr>
</tbody>
</table>
### Evaluating biological issues

The candidate communicates by:
- critically analysing and evaluating information and data from a variety of sources to determine validity, reliability and bias
- integrating the information and data to make justified and responsible decisions
- comparing alternatives and predictions relevant in past, present and future biological contexts.

The candidate communicates by:
- analysing and evaluating information and data from a variety of sources to determine validity, reliability and bias
- integrating the information and data to make logical decisions
- recognising alternatives and predictions that are relevant in a range of past and present biological contexts.

The candidate communicates by:
- analysing information and data from a variety of sources to determine validity and bias
- selecting relevant information and data to make plausible decisions and predictions
- recognising concepts that form the basis of present-day biological issues in a range of biological contexts.

The candidate communicates by:
- making statements related to source material
- making unsupported decisions
- recognising that a given issue has biological implications.

The candidate communicates by restating supplied information.