Senior External Examination

Queensland Government

Queensland Studies Authority
Partnership and innovation

Biology

Paper Two — Sample

This is a sample examination paper based on the 2006 Senior External Syllabus in Biology.
The 2006 syllabus will be implemented in 2007.
The first examination based on this syllabus will take place in 2007.

Directions

1. Perusal time: **10 minutes**.
   Do not make notes in this paper during perusal time.
2. Working time: **2 hours.**
3. Materials provided:
   - response book for Part B (not available for the sample examination paper).
4. Equipment allowed:
   - normal writing implements
   - other QSA-approved equipment.
5. This paper contains:
   - formatted pages for responses to Part A
   - planning space on pages 8 and 9 for all draft work.
6. This paper has **two** parts:
   - Part A: Questions 1–7 Short response
   - Part B: Questions 1–8 Extended response.

   Attempt **all** questions.
7. Clearly cross out any draft work that is not to be assessed.
8. Do not take this paper, used or unused, from the examination room. Do not tear out any part of this paper. The supervisor will collect this paper when you leave the examination room.

Candidate use

Print your candidate number below								
0	6	–					–	

Affix your barcode here

Number of books used

Supervisor use only

Supervisor's initials	

QSA use only

Examiner number	

Notes

Suggested time allocation:

Part A: 30 minutes
Part B: 90 minutes.

Assessment:

This paper assesses the following criteria published in the 2006 Senior External Syllabus in Biology:

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

The criterion assessed by each question is indicated in brackets after each question.

Criteria and standards for assessment are on pages 10 and 11 of this paper.

Planning space

Part A

Short response

Suggested time allocation: 30 minutes.

This part has seven questions of equal value. Attempt all questions.

Respond to the questions in the spaces provided.

Question 1

In a multicellular organism the growth rate of a cell decreases as the cell gets larger. State the most probable reason for this.

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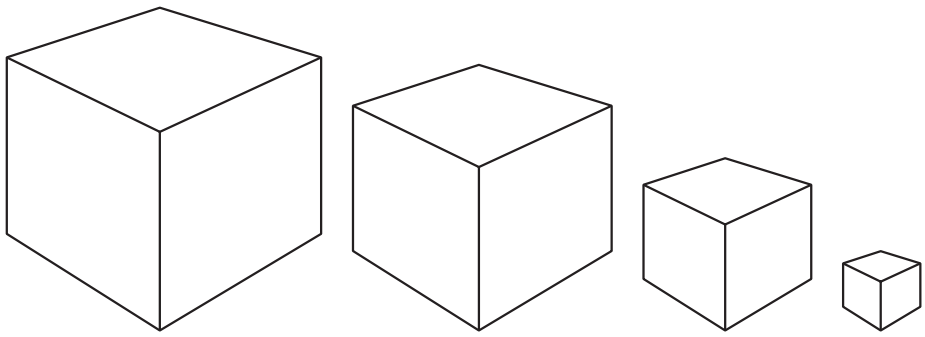
……

(UB)

Question 2

The four cubes below are drawn to the same scale.



I **II** **III** **IV**

List them in order of a decreasing surface area to volume ratio (from largest to smallest).

……

(UB)

Question 3

Overpopulation of a species can occur for various reasons. Name a particular species that is considered to be overpopulated in Australia and explain why this overpopulation is a problem.

.....

.....

.....

(UB)

Question 4

Refer to the table below.

Transpiration rate and water absorption rate for corn plants (g of water per 2 hour interval)

Process	Time							
	12 noon to 2 pm	2 pm to 4 pm	4 pm to 6 pm	6 pm to 8 pm	8 pm to 10 pm	10 pm to 12 midnight	12 noon to 2 am	2 am to 4 am
Transpiration	34	45	53	47	27	15	10	5
Absorption	20	31	42	48	35	23	16	11

When could the diameter of the stem be expected to be the smallest – 2 am or 2 pm?

.....

(IB)

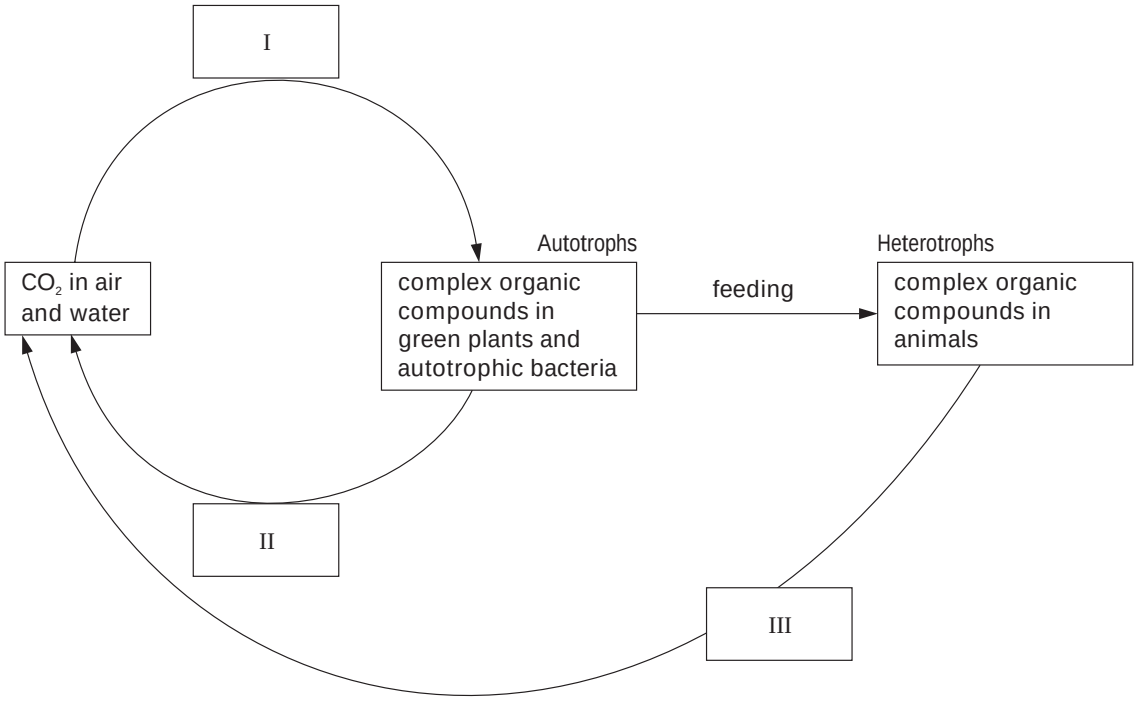
Question 5

Use a diagram to describe a likely outcome involving salinity, from continually farming small sized annual crops and pastures instead of maintaining a certain number of deep-rooted trees.

(EBI)

Question 6

The diagram below is a representation of the carbon cycle.



Indicate the process occurring at I.

.....

(IB)

Question 7

Cytochrome-c is a protein involved in the cellular respiration biochemical pathways of all living things. The number of differences in the amino acid sequence in this protein taken from different organisms can be used as an indicator of evolutionary relationships. In the box below, draw a phylogenetic tree that accurately represents the evolutionary relationships between the organisms in the table.

Organism	Number of differences in cytochrome-c compared to humans
Monkey	1
Sheep	10
Kangaroo	10
Chicken	13
Snake	14
Tuna	21
Yeast	45

(IB)

End of Part A

Part B

Extended response

Suggested time allocation: 90 minutes.

This part has eight questions of equal value. Attempt all questions.

Write an extended response to each of the questions in the response book provided (not available for the sample examination paper).

Question 1

Read the following article describing the use of stem cells taken from aborted fetuses. These stem cells are used, with the aid of IVF (in vitro fertilisation), to help infertile couples conceive. Stem cells are cells that have the unique potential to develop into any kind of cell in the body.

New technologies such as stem cell manipulation and IVF bring both happiness and concern to couples in modern society. Discuss whether these technologies are necessary, and whether all couples should be eligible for these types of treatment regardless of the type of relationship they are in. You must justify your reasoning scientifically.

(EBI)

Stem cells raise fertility hopes

A process that appears to turn embryonic stem cells into egg-containing ovaries may eventually assist infertile women to have children. However, it has already aroused a scare campaign.

A successful attempt to turn an embryonic stem cell into an ovary was made in 2003, but attempts to replicate the achievement failed. Dr Orly Lacham-Kaplan of the Monash Immunology and Stem Cell Laboratories has overcome this obstacle. Her method is to place groups of stem cells in a growth medium conditioned with testicular cells. These were chosen because the testis is a good source of growth factors.

"To make embryonic stem cells form any specific tissue you need a trigger. Here, that is specific growth factors," Lacham-Kaplan says. The result is an ovary-like structure containing objects that look like, and have chemical markers matching, eggs. However, Lacham-Kaplan says she does not yet know if the products are functional.

Lacham-Kaplan hopes that eventually her work will lead to a situation where infertile women can develop eggs, using either existing embryonic stem cell lines or through therapeutic cloning, where the genetic material in an egg would be replaced with genetic material from the mother. She adds that the work could "also reduce the strain on donor egg programs".

Presenting her work at a scientific conference in Copenhagen, Lacham-Kaplan says the response was "very favourable, very supportive". However, coverage has led to criticism.

"Anything to do with embryonic stem cells is controversial, and with reproductive technology also. So if you put them together it is doubly controversial," she says.

"We used XY stem cells because we were trying to reproduce the original research." She suspects the earlier work was done with male stem cells simply to prove that the product really was from the stem cells. In fact, Lacham-Kaplan believes that the use of male stem cells may have reduced the functionality of the eggs.

Lacham-Kaplan's next plan is to use stem cells from a female line to see if she can produce functional eggs. If she wins approval she will then try to move from mice cells to repeat her work for humans.

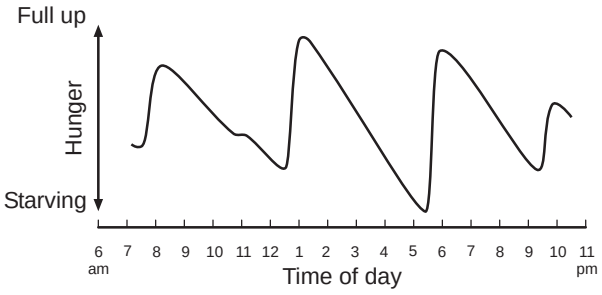
Australasian Science

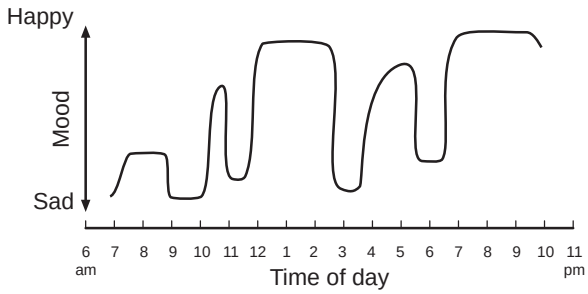
August 2005

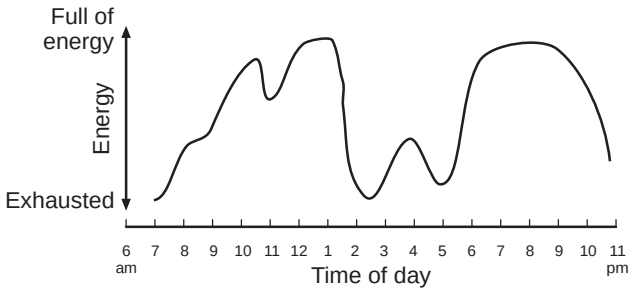
Question 2

Use your knowledge of the operation of the digestive system and the information in the graphs below to respond to the following task:

Describe the relationship between hunger, energy and mood. Develop a program to reduce the physiologically induced unhappiness that this person experiences at various times of the day and explain how your suggested program will reduce the person's mood swings.







(EBI)

Question 3

While plant cloning has long been an accepted part of successful horticultural practices, the cloning of animals (including humans) has been widely criticised.

What changes to society may occur if all opposition to cloning research, development and implementation, both legislative and ethical, were removed? You must explore positive and negative outcomes.

(EBI)

Question 4

A dihybrid cross from two pure-bred parents will always produce an F2 (second generation cross offspring) ratio close to 9:3:3:1. Expand on this by indicating the dominant and recessive alleles from the two unrelated characteristics being investigated that are indicated in this ratio. A worked example may be helpful.

(UB)

Question 5

One Australian marsupial is known by all the following common names – pygmy flying possum, flying mouse, feathertail, pygmy flying phalanger, pygmy glider, feather tail glider. The same marsupial is known by the scientific name *Acrobates pygmaeus*.

Two debating teams (for and against) could make use of this information in a debate on the motion "That scientific names are of no use because of their complexity".

Choose the team which you think could make most use of this information about the *Acrobates pygmaeus*. Explain fully how they could use this information to support their argument.

(UB)

Question 6

Artificial selection by humans has developed some species of animals with extremely altered body shapes that may sometimes be life threatening, for example a pug dog's compacted nasal passage inhibits clear breathing.

Discuss how artificial selection in domestic breed development may need to be carefully monitored to protect the animals themselves from fashion trend extremes.

(EBI)

Question 7

Using the extended experimental investigation data you brought into the examination room with you, write a brief report that covers the following:

- the hypothesis being investigated
- a summary of the results
- an analysis of the findings
- further ways the investigation can continue
- potential use of the results of this type of investigation.

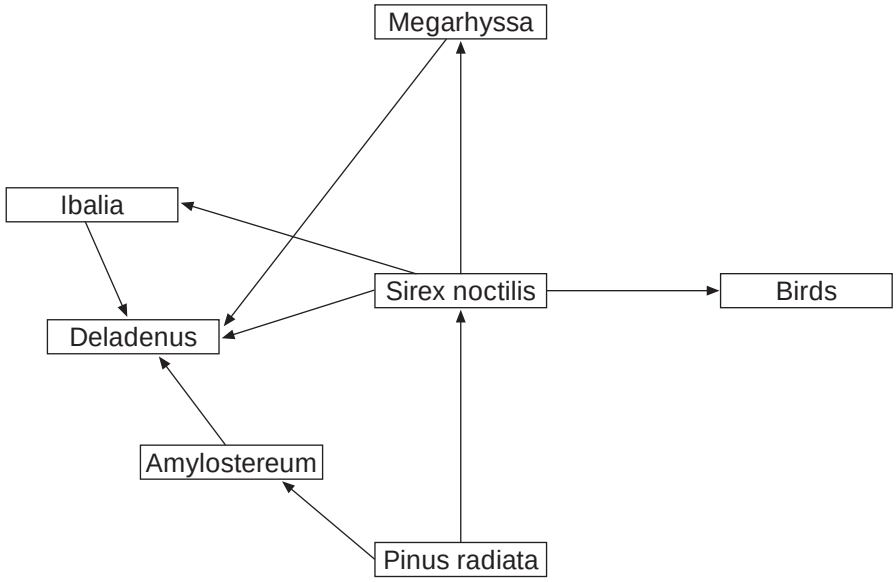
(IB)

Question 8

The Sirex wood wasp, *Sirex noctilis*, lays eggs in holes bored in the trunks of pine trees (*Pinus radiata*) with filaments of a symbiotic fungus, *Amylostereum*. It is this fungus which may kill the tree, and so Sirex threatens plantations of pine trees.

The cure that has been sought is the introduction of the parasitic wasps *Megarhyssa* and *Ibalia*, both of which lay their eggs in the larvae of the Sirex. Birds also kill adult wood wasps and their young. A species of nematode worm, *Deladenus*, also parasites the wood wasps, sterilising females which then lay only egg shells packed with young nematode worms.

Further, the nematodes occur not only in this parasitic form, but also in a free-living form that feeds on the fungus, *Amylostereum*. The parasitic form of the nematode uses, as hosts, not only the wood wasps, but also the wasps that are parasitic on *Sirex noctilis*.



A field worker noticed that, in an area where large numbers of *Megarhyssa* wasps were seen, few infections of the fungus *Amylostereum* were detected. They also noticed that, in areas where *Megarhyssa, Ibalia* and *Deladenus* had been introduced some years before, Sirex wasps were still in existence.

Analyse the success of the strategies used in the biological control of Sirex wasps, providing justifications for any conclusions you reach.

(EBI)

Planning space

Planning space

Standards associated with exit levels of achievement

	A	B	C	D	E
Understanding biology	The candidate communicates understanding by: • making links between related ideas, concepts, principles and theories to reveal meaningful interrelationships • applying knowledge and understanding to a range of complex and challenging tasks.	The candidate communicates understanding by: • explaining ideas, concepts, principles and theories and describing interrelationships between them • applying knowledge and understanding to a range of complex tasks.	The candidate communicates understanding by: • defining and describing ideas, concepts, principles and theories, and identifying interrelationships • applying knowledge and understanding to a range of tasks.	The candidate communicates understanding by stating ideas and using terminology relevant to concepts and recalling interrelationships.	The candidate states terminology and ideas relevant to concepts.
Investigating biology	The candidate communicates investigative processes by: • formulating justified researchable questions • designing an investigation by providing methodology, addressing variables and control, planning replicate treatments and identifying data to be collected • organising data to identify trends and interrelationships • interpreting and critically analysing data with links to theoretical concepts to draw conclusions relating to the question(s) • evaluating the design of the investigation and reflecting on the adequacy of the data collected and proposing refinements.	The candidate communicates investigative processes by: • formulating researchable questions • designing an investigation by providing methodology, addressing obvious variables and control and planning replicate treatments • organising data • interpreting data and drawing conclusions relating to the question(s) • evaluating the design of the investigation and the adequacy of the data collected.	The candidate communicates investigative processes by: • identifying researchable questions • designing an investigation by providing incomplete methodology with few variables and attempts to include a control • organising data • using data to draw conclusions.	The candidate communicates investigative processes by: • using data to answer questions • designing an investigation which provides incomplete methodology and mentions variables • attempting to organise data.	The candidate communicates investigative processes by providing incomplete methodology, and transcribes data.

	A	B	C	D	E
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.

Acknowledgments

Control Publications Pty Ltd, Victoria, for text from *Australasian Science*, Volume 26, Number 7, published August 2005.