2006 Senior External Examination

Chief Examiner report for candidates and teachers

Biological Science

In 2006, 49 candidates sat the Biological Science examination. The table below shows the exit levels of achievement awarded for each of the last five years.

Year	Number of candidates who sat	Level of achievement				
		VHA	HA	SA	LA	VLA
2006	49	4	11	27	5	2
2005	47	0	5	31	10	1
2004	90	4	20	31	18	17
2003	91	4	11	35	27	14
2002	122	9	29	48	18	18

The 2006 marking guide is included at the end of this report. It is not intended to provide definitive responses to the questions in the examination papers, but has been provided to help teaching centres prepare candidates for future Biology examinations.

General comments

While the number of candidates who sat the examination was similar to that of 2005, and considerably lower than in previous years, their results were encouraging. Over 85% of candidates received a Sound level of achievement or higher. Compared to last year, there was a general improvement in the overall quality of candidates' responses. This shows the value of the work being done by teaching centres as they follow advice given in the 2005 Chief examiner report and access other relevant information provided.

The creative responses submitted for questions in Paper Two were particularly pleasing. These questions enabled candidates to demonstrate their higher order thinking skills when processing information related to a variety of biological science concepts in their extended responses. This year there were considerably fewer questions omitted in this traditionally more difficult paper. However, those scripts with incomplete, or omitted, answers risked the possibility that a lack of evidence may not allow the candidate to be awarded the level of achievement they may have otherwise received. Levels of achievement can only be awarded on the evidence demonstrated. The upper ranges of responses produced were creative, allowing for solid demonstrations of candidates' abilities. Almost no questions in Paper One were omitted, indicating an improved level of confidence in candidates.

To be awarded a particular level of achievement a candidate must demonstrate a consistency in their responses that is reflective of the level of achievement. Small adjustments can be made in accordance with the syllabus to compensate for an excess in one criterion and a slight deficiency in another.

It was pleasing to see that candidates were “actively reading” questions using highlighters or other techniques, as it showed an improvement in their comprehension level during the examination. The responses reflected this improvement.

As in previous years, there was a range of general spelling mistakes but these were few in the words reflecting a comprehension of biological science concepts. Overall, the scripts were legible with few errors.

Comments on each section

Paper One — Part A: Multiple choice

No candidates omitted any multiple-choice questions, which is encouraging. While the result overall in the criterion for Scientific processes reflects a good ability to interpret scientific data correctly, a lower overall result for the criterion for Knowledge in what is essentially the easiest section of the examination – simple recall and application of biological science concepts – is disappointing. Candidates should be able to move through this section quickly and competently to give them a clear grounding for the application of the knowledge in the other criteria.

Paper One — Part B: Short response

There were clear differences in the responses provided to the papers between candidates who read the questions accurately and responded to what was required in a simple straightforward manner, and those candidates who rushed their responses and only picked up key words in the questions. The latter often missed the specific point of the question and therefore did not gain credit for the biological science knowledge they demonstrated because it was irrelevant to the actual question. Some candidates also gave responses that reflected an over-use of past examination papers to prepare for this examination. This practice should be monitored and balanced by the teaching centres with other forms of revision.

Detailed information about each question can be found in the marking guide.

Paper Two — Complex reasoning processes: Extended response

As stated earlier in this report, results in this criterion showed a marked improvement in general when compared with previous years. Most candidates attempted each question. While each question focuses on multiple components of the Complex reasoning criterion, omitting responses may prevent markers grading a candidate highly overall despite one or two questions being dealt with very well. Therefore, it is imperative that candidates plan their time and their responses accurately to allow them to demonstrate a full range of higher order thinking skills. There was evidence of planning in some candidates’ responses, producing well thought out responses that were easy to read and to assess appropriately.

Question 1 — Experimental design with drug testing

This was very well handled with most candidates demonstrating a thorough knowledge of sound experimental design, controls and variables. A few candidates would have benefited from improving the setting out in their responses to allow for simple “double-checking” to ensure no sections of the question are overlooked.

Question 2 — Inherited enzyme deficiency (genetics)

This question was poorly handled by some candidates, reflecting a lack of depth in the knowledge of the genetics behind inherited conditions. Other candidates began well but did not provide a complete discussion which affected their overall result. Very few candidates provided a solid justification for their findings – while the answer may be correct, it is the reasoning behind it that is being examined in these types of questions.

Question 3 — Treatment for Cystic Fibrosis — effect on the gene pool

Candidates' responses indicated that they found this question difficult. Candidates did not demonstrate the basic understanding of natural selection that for changes to occur in the gene pool, the changes must be in the germ cells so that the changes can be passed on to the next generation. If only treatment of the individual's somatic, or body, cells occurs, then not only are their sperm or egg cells remaining unchanged, they are also surviving longer to be able to pass on these defective genes to more offspring. This is effectively increasing the proportion of the population exhibiting the disease. Most candidates confined their responses to the benefits for the individual without dealing with the question's focus on the impact on the population.

Question 4 — Diatom population changes

This was dealt with fairly well but a large proportion of candidates did not allow time for the populations to build in number, which affected their interpretations.

Question 5 — Effects of poisons on populations

One of the main parts of this question was to provide alternatives to the use of poisons based on their detrimental effects. Once again, few candidates went to the depth required to show a thorough understanding and their ability to use higher order thinking skills. Possibly such an open question at the end of the examination did not hold the concentration of some candidates sufficiently.

2006 Marking guide

Paper One

Part B

Short answers

Suggested time allocation: 120 minutes

This part has 11 questions.

Answer all questions in the spaces provided.

Question 1

Explain the importance of making sure that all the possible influencing variables in an experiment (except the one being manipulated) are controlled and kept at a constant level across all treatments.

To make certain only one variable is being tested in the experiment.

(SP)

Question 2

Explain the difference between heterozygous and homozygous.

Heterozygous - different alleles (forms) of the gene
Homozygous - same alleles of the gene

(K)

Question 3

The drawing below shows the chromosomes in the nucleus of a skin cell of a mammal.

Determine the haploid number of chromosomes for this species.

6

(K)

Question 4

In a biological science examination paper one student wrote:

"In droughts, grass was scarce and some animals stretched their necks to feed from the leaves of trees. These animals survived and their young had long necks. In this way giraffes evolved long necks."

Refer to the above statement and suggest a more accurate explanation in terms of the principle of evolution by natural selection.

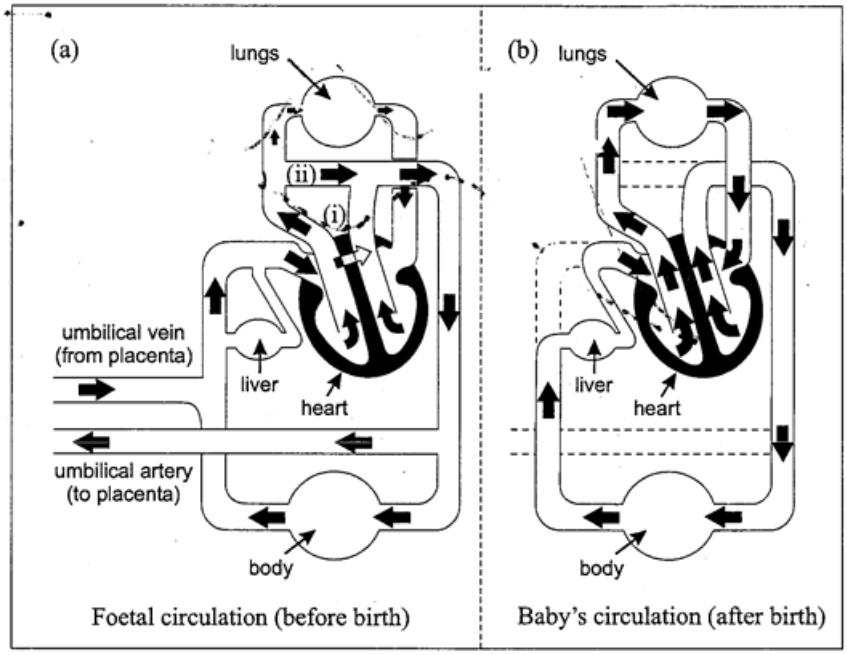
Variation in neck length allowed some to have a longer neck. In drought it was only these who could reach the uppermost leaves and hence survive to reproduce and pass on the "longer neck" gene.

(~~SP~~) K

Question 5

The diagrams below show the circulatory systems of a human foetus and a human baby. The major differences between the two systems are:

- foetal lungs are non-functional before birth
- in foetus systems about 60% of the blood that enters the right atrium passes through the *foramen ovale* - indicated on the diagram at (i) – to the left of the atrium
- most of the remaining 40% passes via the *ductus ateriosis* – indicated on the diagram at (ii) – into the body circulation.



Describe the disadvantages that these bypasses would present for the baby after birth if they remained unchanged.

- Oxygenated and Deoxygenated blood would mix if the foramen ovale did not close.

OR

- Most blood would not go to the lungs if the ductus ateriosis doesn't close.

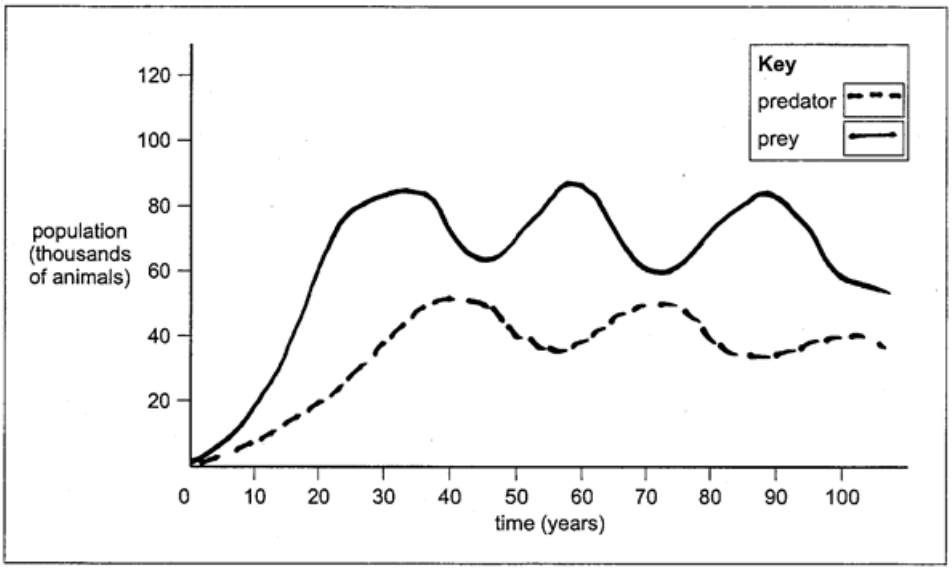
(SP)

(one answer is sufficient)

Question 6

In the space below sketch a graph that depicts population fluctuations of both organisms that would be predicted in a typical predator–prey relationship.

HINT: complete the key



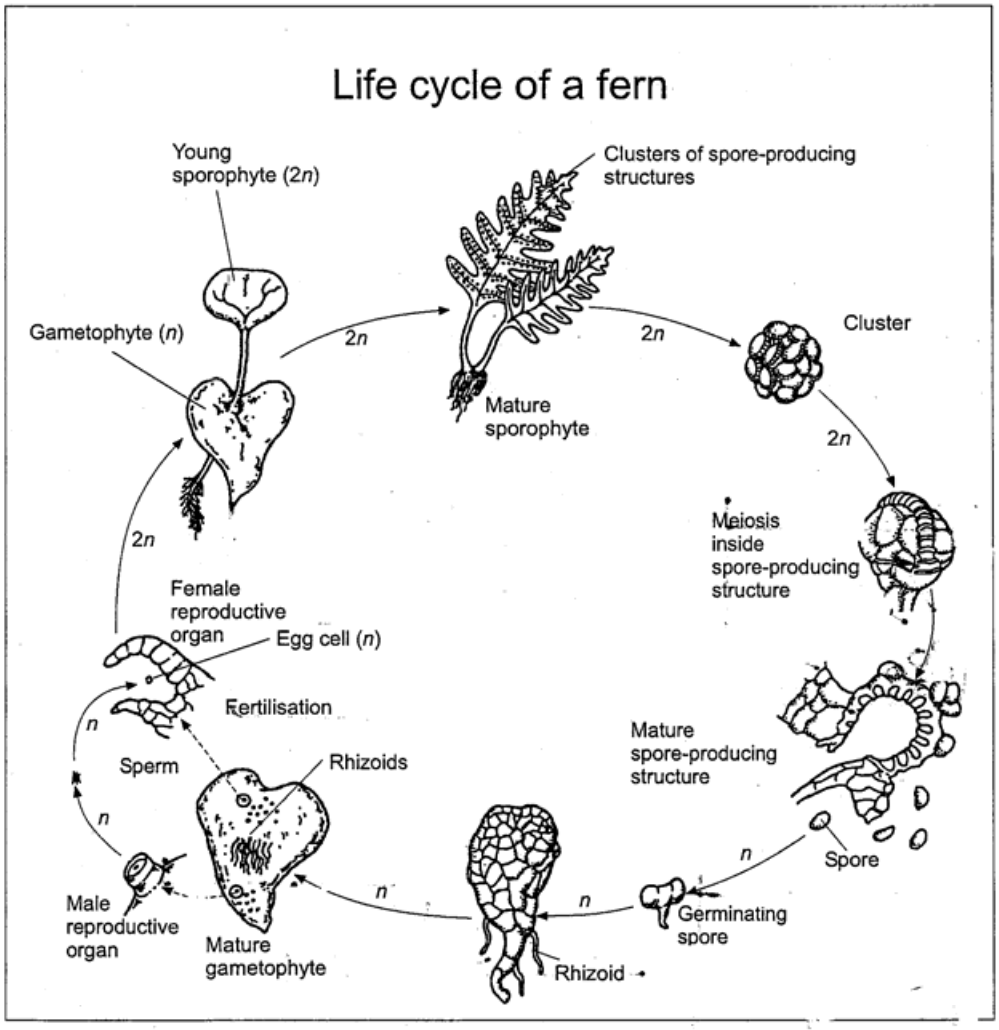
(SP)

Question 7

Different organisms have different life cycles with respect to the points at which meiosis and fertilisation occur. Two different models are described in the table below.

Model A	Meiosis and fertilisation occur at separate times and the organism has a distinct haploid and diploid stage.
Model B	Meiosis is followed almost immediately by fertilisation and most of the life cycle of the organism is diploid.

With reference to the fern life cycle represented in the diagram below, which of these two models matches best?



model A

(SP)

Question 8

State one requirement for a respiratory surface to be efficient in the role of gas exchange.

large surface area, moist, thin barrier for transfer

(one of the above) (K)

Question 9

Using an Australian example, briefly state one possible negative effect that the introduction of a new species may have on the local environment.

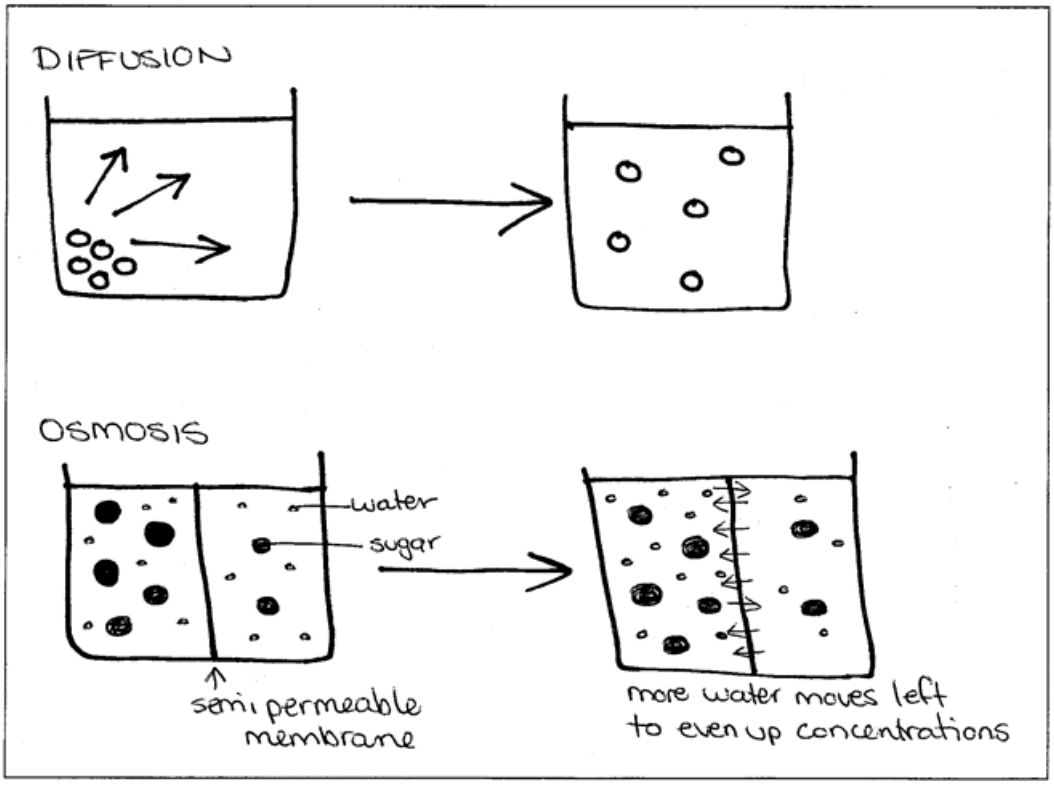
any suitable pest and brief explanation of the effect

eg cane toad, feral cats, rabbits

(K)

Question 10

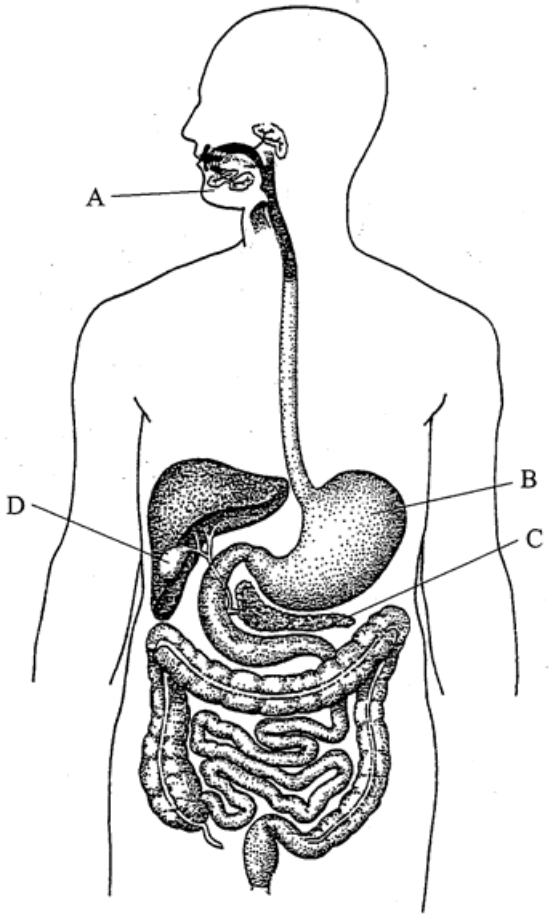
In the space below draw one or more diagrams that explain the difference between the terms osmosis and diffusion.



(SP)

Question 11

Below is a diagram of the human digestive system. Choose ONE of the organs labelled A, B, C or D and outline its main function including any secretions that it may produce.



(A) - Salivary glands - produce saliva containing amylase for carbohydrate digestion (B) stomach - food storage organ producing HCl, pepsinogen enzyme and gastric lipase for fat breakdown (C) Pancreas - produces digestive enzymes and neutralises acids (D) Gall bladder - stores bile produced to break up fats and oils. (K)

only one needs to be discussed

Paper Two

Part	/	Topic	

Controls - same ages for each drug
- similar health - no bacterial infection before
- same number males & females

Three groups of people - record body temperature
Inoculate with bacteria
Group 1 - take tablet
Group 2 - injection
Group 3 - no drug

After 3 days record body temperature.
If drug is more effective by injection,
group 2 should have normal, or lower
body temperature than group 1.

Part	2	Topic	

Males - severe symptoms
females - milder
But small proportion - severe symptoms

Inheritance - Sex linked recessive
+ incomplete dominance

Genotypes	Phenotypes
$X^N Y$	Normal male - no symptoms
$X^n Y$	Affected male - severe symptoms
$X^N X^N$	Normal female - no symptoms
$X^N X^n$	Carrier female - mild symptoms
$X^n X^n$	Affected female - severe symptoms.

Sex linked because the severity of the symptoms relate to whether the person is male or female

Incomplete dominance accounts for the difference in severity in females. If this was complete dominance, only $X^n X^n$ would display symptoms and there would be no difference in severity. $X^N X^n$ and $X^N X^N$ would both not show the symptoms

Part	3	Topic	

Cystic fibrosis

The insertion of the healthy gene in the lungs for treatment of CF in humans would enable CF patients to live longer and have a greater chance of reproducing. This would mean there would be an increase of the CF gene in the gene pool. The healthy genie that is inserted would not enter the gene pool, as the gene only enters cells in the lungs, not the ovaries and testis, therefore not being part of reproduction.

Part	4	Topic	

Eutrophication is a build up of mineral nutrients (eg phosphates) in a body of water. When there is a high build up there is an increased growth of producers (eg diatoms)

Early in September (before the 8th), there was a high concentration of phosphates. This led to an increase in the number of diatom chains (up to 2 million per litre on the 15th) This increase in diatoms caused a decrease in the phosphates. The nutrient availability for the diatoms decreased, so after the 15th the population decreased.

The fluctuations of the phosphates after the 15th could be due to the release from the industrial areas (15th, 17th-19th, 22nd, 24th, 26th). This has also led to a slight increase in diatoms after the phosphate increase of the 22nd

To overcome this problem, control of the release from industry need to be in place

Part	5	Topic	

Destruction of beneficial bacteria - problems with natural cycles such as the nitrogen cycle. Bacteria affected ⇒ plants don't grow ⇒ food chain disrupted

Reduced resistance - poisons will no longer be effective on pests. A new poisons may be required - this would need to be biodegradable

The poisons may also stay in the environment and/or they may accumulate in the food chain, causing problems for other species

Alternative - find a biological control agent. This agent must feed only on the pest, so that when the pest species has been killed, the biological control agent will die out and not become a pest

The ideal is to create a balance of small numbers of both pest and control. This is to prevent outbreaks of the pest which may occur if the control is eradicated

OUTCOME	VHA + 0 -	HA + 0 -	SA + 0 -
Solve Challenging Problems Question 3, 4, 5	Demonstrated ***high ability to solve challenging problems*** through the use of complex reasoning in challenging situations involving the candidates understanding of the subject matter and a ***high ability to use scientific processes*** at an advanced level.	Demonstrated ***competence in the ability to solve challenging problems*** through the use of complex reasoning in challenging situations involving the candidates understanding of subject matter and ***competence in using scientific processes*** at an advanced level.	Demonstrated ***some success in solving challenging problems*** through the use of complex reasoning in challenging situations involving the candidates understanding of subject matter and ***some success in using scientific processes*** at an advanced level.
Make Logical Decisions Question 1, 2, 5	Demonstrated ***high ability to make logical decisions*** through the use of complex reasoning in challenging situations involving the candidates understanding of the subject matter and a ***high ability to use scientific processes*** at an advanced level.	Demonstrated ***competence in the ability to make logical decisions*** through the use of complex reasoning in challenging situations involving the candidates understanding of subject matter and ***competence in using scientific processes*** at an advanced level.	Demonstrated ***some success in making logical decisions*** through the use of complex reasoning in challenging situations involving the candidates understanding of subject matter and ***some success in using scientific processes*** at an advanced level.
Use creative or critical thinking Question 1, 3, 4	Demonstrated ***high ability to use creative or critical thinking*** through the use of complex reasoning in challenging situations involving the candidates understanding of the subject matter and a ***high ability to use scientific processes*** at an advanced level.	Demonstrated ***competence in the ability to use creative or critical thinking*** through the use of complex reasoning in challenging situations involving the candidates understanding of subject matter and ***competence in using scientific processes*** at an advanced level.	Demonstrated ***some success in using creative or critical thinking*** through the use of complex reasoning in challenging situations involving the candidates understanding of subject matter and ***some success in using scientific processes*** at an advanced level.

OUTCOME	Q1	Q2	Q3	Q4	Q5	LOA	OVERALL
Solve Challenging Problems						VH HA SA	VH
Make logical decisions						VH HA SA	HA
Use creative and/or critical thinking						VH HA SA	SA