

Senior External Examination



Biology Paper One — 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

- Perusal time: **10 minutes**.
Do not make notes in this paper during perusal time.
- Working time: **2 hours 30 minutes**.
- Materials provided:
 - multiple-choice response sheet for Part A (not available for the sample examination paper).
- Equipment allowed:
 - 2B pencil (for completing the multiple-choice response sheet)
 - eraser
 - normal writing implements
 - other QSA-approved equipment.
- This paper has **two** parts:
 - Part A: Questions 1–14 Multiple choice
 - Part B: Questions 1–15 Short response.Attempt **all** questions.
- This paper contains:
 - formatted pages for responses to Part B
 - planning space on pages 19–21 for all draft work.
- Clearly cross out any draft work that is not to be assessed.
- 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: 120 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 22 and 23 of this paper.

Planning space

Part A

Multiple choice

Suggested time allocation: 30 minutes.

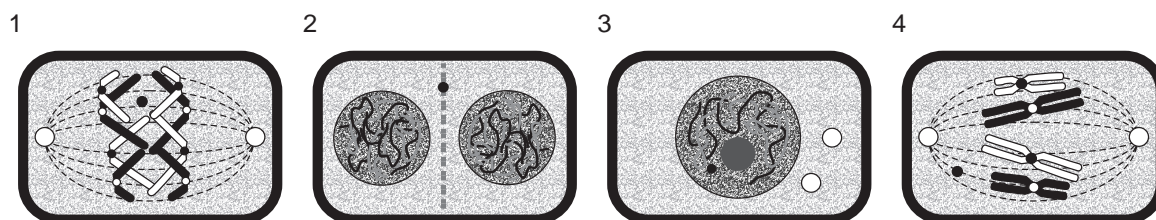
This part has 14 questions of equal value. Attempt all questions.

Each question has four options, **one** of which is correct or is the best option. Respond to each question by selecting one of the four possible options and blackening the appropriate circle on the multiple-choice response sheet provided (not available for the sample examination paper). Use a 2B pencil to blacken the circles.

No credit for your response will be given if more than one circle is blackened.

Question 1

The following diagrams depict the process of mitosis.



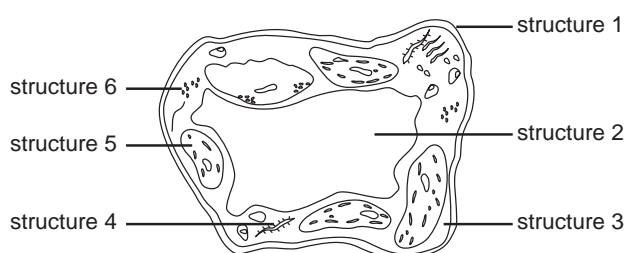
Place the diagrams in order, starting with Prophase.

- A 1, 2, 3, 4
- B 4, 2, 1, 3
- C 3, 4, 1, 2
- D 2, 1, 3, 2

(UB)

Question 2

The diagram below shows a plant cell which has six structures.



Which of the following correctly identifies the structures that would **NOT** be found in an animal cell?

- A structure 1, structure 5
- B structure 2, structure 3
- C structure 1, structure 4
- D structure 6, structure 5

(UB)

Question 3

In a research investigation, mould was grown on agar plates containing different concentrations of Vitamin B6. Measurements of the size of the mould colonies were made daily and the following results were recorded:

Concentration of Vitamin B6 (micrograms per 25mL of nutrient medium)	Average growth rate of mould (cm per day)
0.004	2.0
0.015	2.0
0.030	4.5
0.060	8.5
0.250	10.0
1.000	10.0

Which one of the following hypotheses is being tested in the experiment?

- A Vitamin B6 is needed for mould growth.
- B Mould growth rate varies with Vitamin B6 concentration.
- C Vitamin B6 concentration determines the growth rate of living things.
- D The diameter of the mould colonies determines the concentration of Vitamin B6 used.

(IB)

Question 4

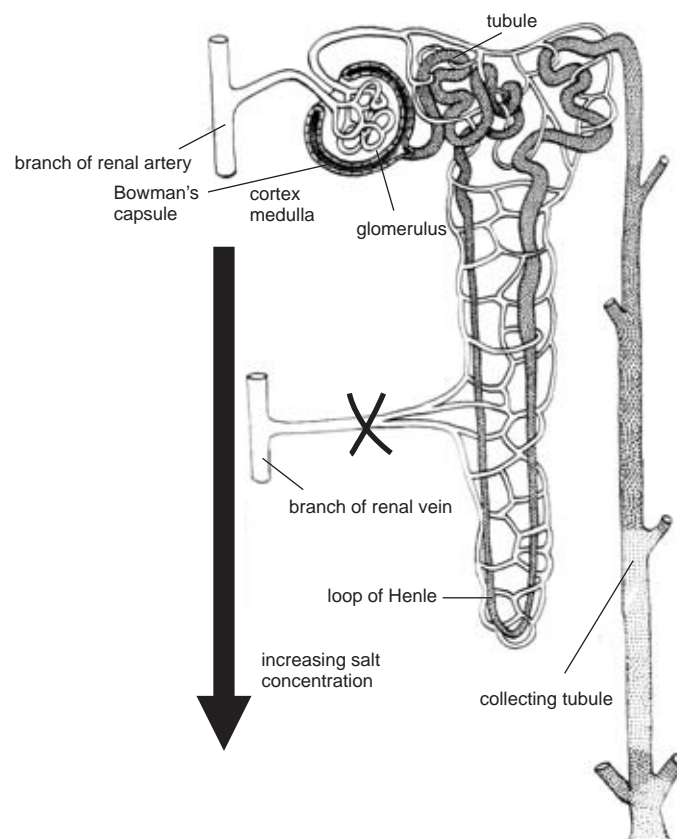
The mechanisms of homeostasis are directed primarily towards the

- A** excretion of toxic end products.
- B** maintenance of a stable cellular environment.
- C** maintenance of equal nutrient supply to all tissues.
- D** maintenance of a constant concentration of all blood constituents.

(UB)

Question 5

The diagram below shows a kidney tubule.



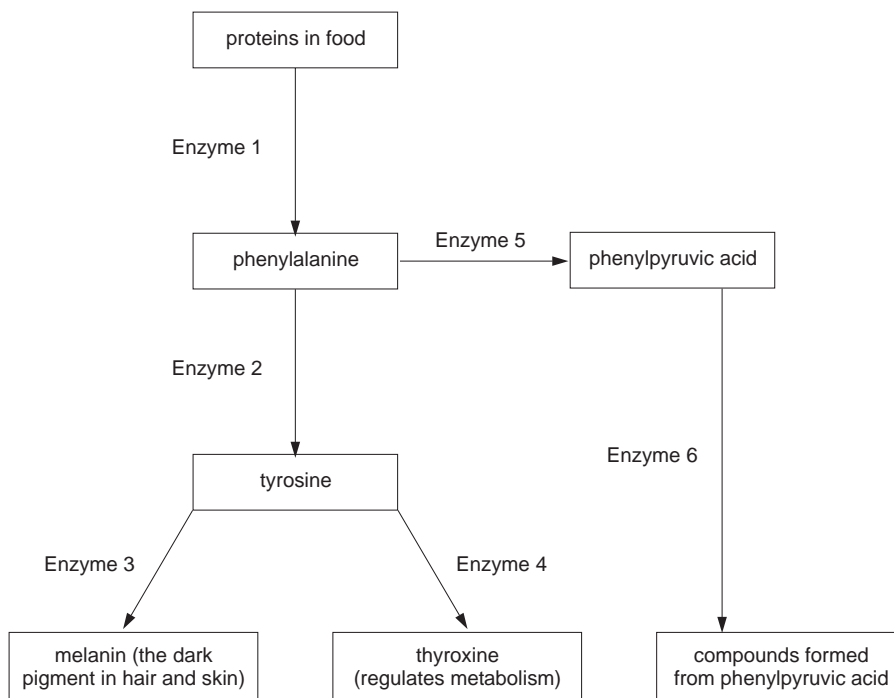
If a blockage occurred at "X" in most of the kidney tubules

- A** the animal would suffer shock due to loss of fluid.
- B** there would be an increase in urea in the bloodstream.
- C** the remaining tubules would compensate for the damaged ones.
- D** the animal would suffer from thirst because of an increase in the ratio of salt to water in the body.

(IB)

Question 6

The diagram below shows a metabolic pathway in a human cell.



People with the genetic disease *phenylketonuria* accumulate phenylalanine and phenylpyruvic acid in their blood. Compounds formed from phenylpyruvic acid can be detected on the skin and have a distinctive odour. People with phenylketonuria usually have light hair.

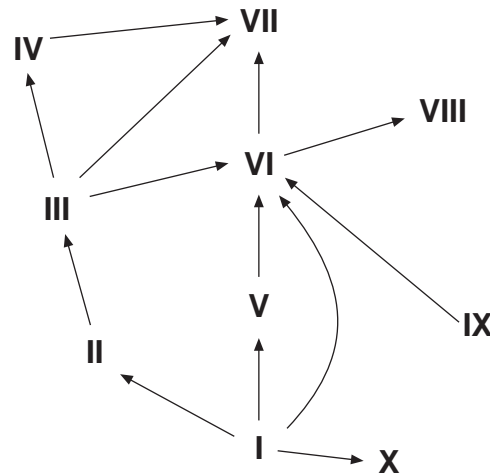
Which one of the following statements is correct?

- A** A lack of Enzyme 1 results in phenylketonuria.
- B** A lack of Enzyme 5 results in an accumulation of phenylpyruvic acid.
- C** A lack of Enzyme 2 results in the light hair associated with phenylketonuria.
- D** A lack of Enzyme 6 results in a distinctive odour from excess phenylpyruvic acid.

(1B)

Question 7

The figure below represents a food web for a simple ecosystem with 10 species (labeled I to X).



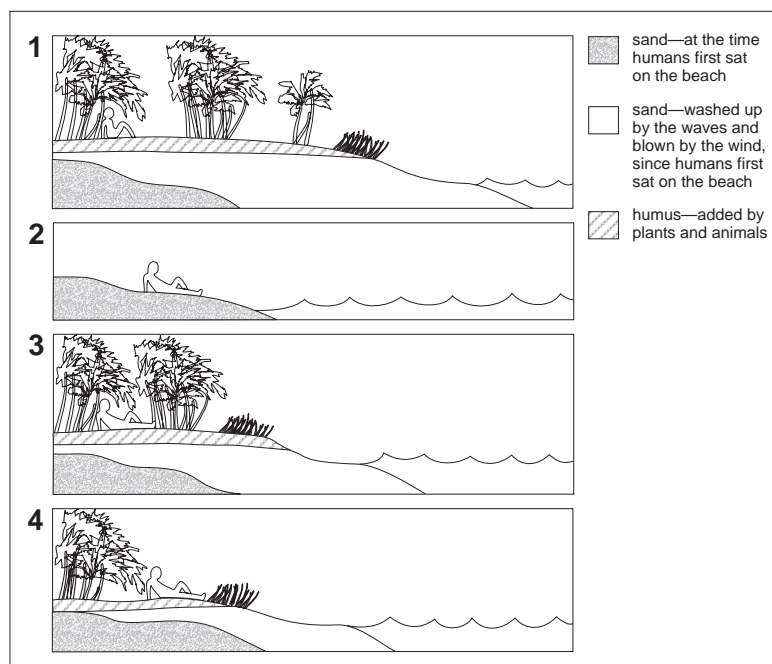
Identify which of the following is most likely an omnivore.

- A V
- B VI
- C VII
- D VIII

(IB)

Question 8

The series of diagrams below represents primary succession in a beach ecosystem. Which of the following is the correct order, from earliest to latest?

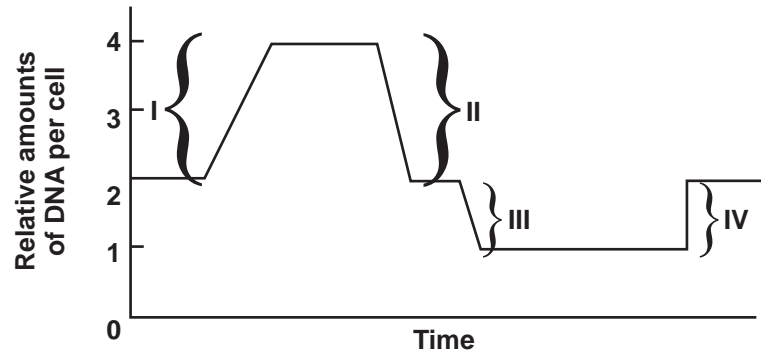


- A 1, 3, 4, 2
- B 2, 4, 3, 1
- C 2, 3, 4, 1
- D 1, 4, 3, 2

(UB)

Question 9

The graph below shows changes in the amount of DNA per cell in a series of cellular events in a mammal.



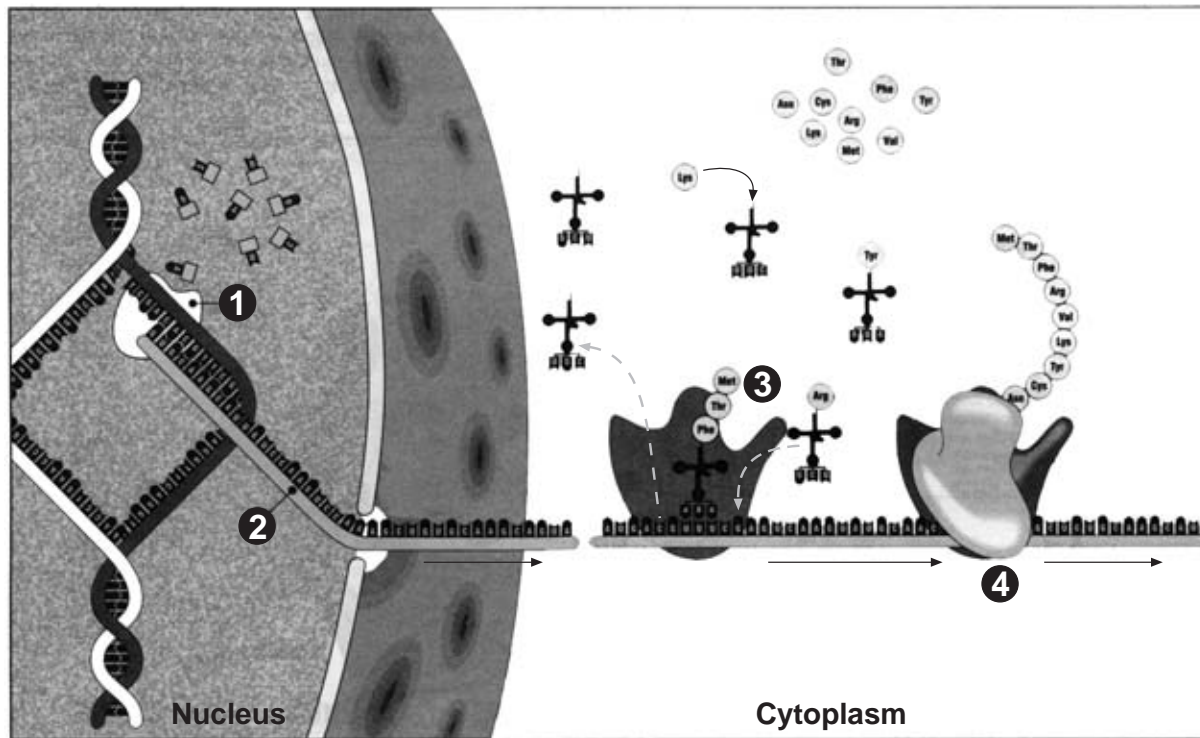
Which one of the following combinations correctly describes the events shown on the graph?

	I	II	III	IV
A	DNA replication	Mitosis	Meiosis	Fertilisation
B	DNA replication	Meiosis 1	Meiosis 2	Fertilisation
C	Fertilisation	Meiosis	Mitosis	DNA replication
D	Mitosis	Meiosis 1	Meiosis 2	DNA replication

(UB)

Question 10

The diagram below shows protein synthesis.



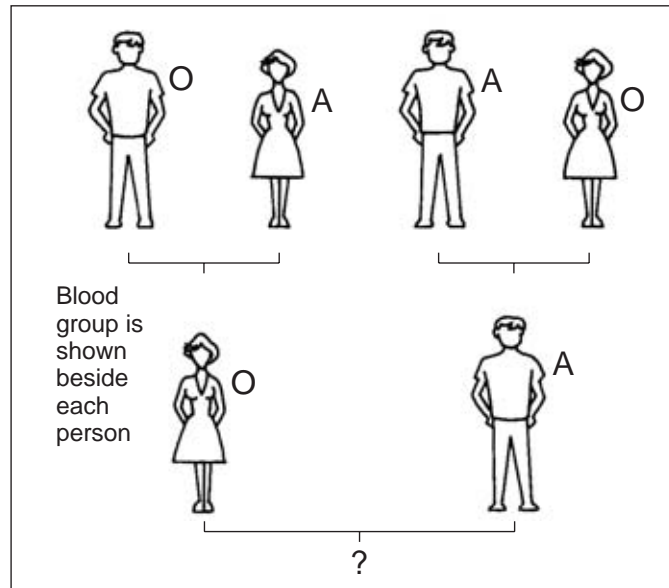
Which of the following represents the correct order of processes and structures?

- A mRNA, transcription, ribosome, translation
- B transcription, mRNA, translation, ribosome
- C transcription, translation, ribosome, mRNA
- D mRNA, translation, ribosome, transcription

(UB)

Question 11

The diagram below shows the blood groups of some people. Blood groups are determined by three alleles, or forms of a gene. Two are dominant and one is recessive.



Choose the correct blood type of the possible offspring that the individuals in the second generation above could produce.

- A AB
- B A
- C B
- D Both A and B

(IB)

Question 12

With reference to the theory of evolution, the greatest advantage of sexual reproduction is the

- A continuance of the species.
- B smaller percentage of eggs that are fertilised.
- C consistency of traits that will appear, generation after generation.
- D variety of organisms within a population that could be produced.

(UB)

Question 13

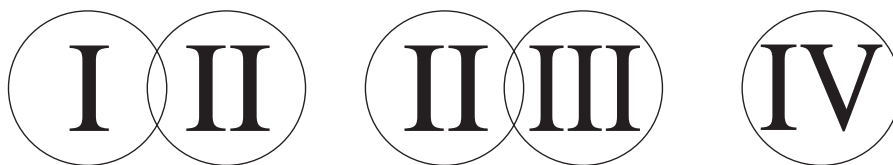
Which of the following statements best reflects Darwin's theory of evolution?

- A** People who acquire a good body tan will have children born with a slight tan.
- B** The breeding of greyhounds for speed changes the inheritance of the animal.
- C** If a mother plays a piano during pregnancy, she will have a musically gifted child.
- D** Birds avoid eating the viceroy butterfly because of its close resemblance to the monarch butterfly.

(UB)

Question 14

The numbers I, II, III and IV below refer to four populations of frogs. These populations are represented diagrammatically by circles; overlapping circles indicate interbreeding of the populations concerned. Where circles do not overlap, no interbreeding of these populations occurs.



It would be reasonable to conclude that

- A** populations I, II, III and IV represent four separate species.
- B** if population III were to die out, there would be only one species remaining.
- C** if population II were to die out, there would be three separate species remaining.
- D** if populations I and IV were to die out, there would be two species remaining.

(IB)

End of Part A

Part B

Short response

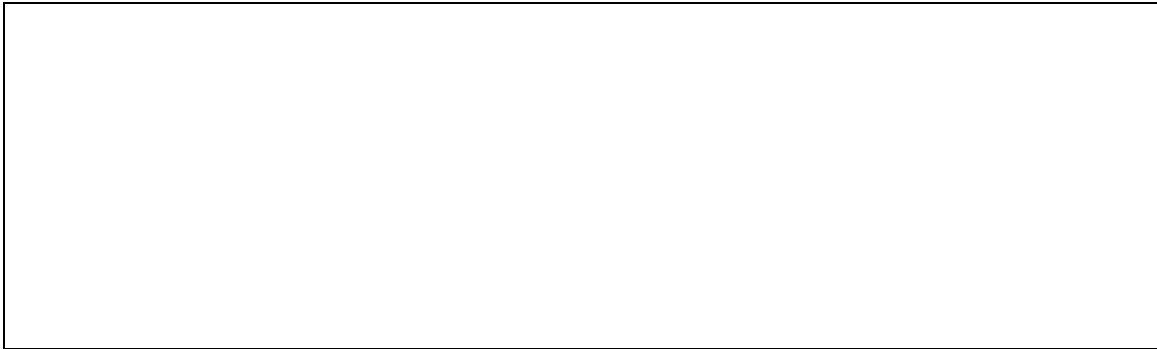
Suggested time allocation: 120 minutes.

This part has 15 questions of equal value. Attempt all questions.

Respond to the questions in the spaces provided.

Question 1

Use a diagram to highlight one structural difference between a prokaryotic cell and a eukaryotic cell.



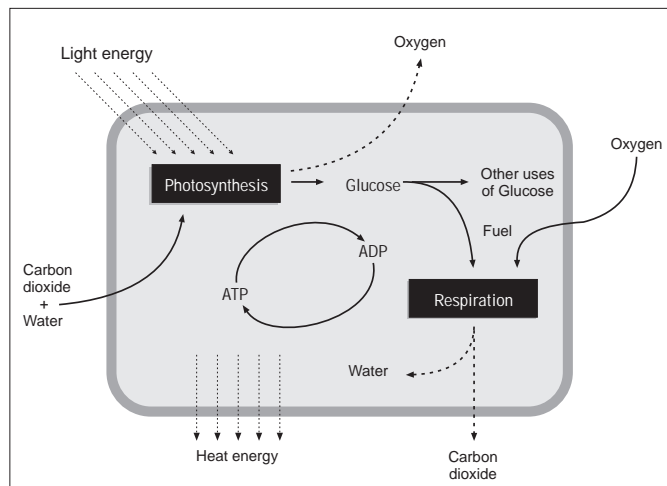
(UB)

Question 2

Use the information in the diagram below to describe the way in which ATP acts as a supplier of energy to power metabolic reactions.

Note: ATP = adenosine triphosphate

ADP = adenosine diphosphate



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(IB)

Question 3

To develop normally, the brain needs thyroid hormone. If there is not enough iodine in the diet, an expectant mother (or the infant) can't make enough thyroid hormone to keep up with the needs of the growing brain. Children with IDD (iodine deficiency disorder) may have poor body movement, hearing problems, an IQ 10-15 points below normal and a greater chance of attention deficit hyperactivity disorder (ADHD).

IDD is the single most common cause of preventable mental retardation and brain damage in the world today. A teaspoon is all a person requires in a lifetime but, because iodine cannot be stored for long periods by the body, tiny amounts are needed regularly.

Before the 1990s, the dairy industry used iodine to clean milking equipment and we got enough iodine from what is called positive contamination. Now the dairy industry uses chlorine.

Outline a social issue that could result from a lack of iodine in Australian diets, stating the impact it would have on society.

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(EBI)

Question 4

Some desert rodents (small mammals such as mice and rats) never drink. They survive quite well on a diet of dry seeds, yet they produce urine and lose moisture from their lungs. What is the most likely source of this water?

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(UB)

Question 5

With regard to wind, humidity and temperature, describe the type of conditions that would cause a plant to wilt quickly.

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(UB)

Question 6

The brain is the control centre for the coordination of the whole body. Drugs affect the brain directly in a variety of ways depending on the type of drug. For example, amphetamines increase arousal. Alcohol and marijuana interfere with information transfer. Hallucinogenic drugs like LSD cause brain activity to be diffuse.

Explain why the acceptance of drug and alcohol use is currently very limited in ‘mainstream’ society – especially when many sporting competitors are found to be using some sort of drugs to enhance their performance.

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(EBI)

Question 7

Clown fish spend much time taking refuge among the tentacles of large sea anemones. They discard food scraps to the anemone and gain significant protection from predators.



Name this type of interaction.

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(UB)

Question 8

Selective logging of timber occurs in the rainforests of North Queensland and results in 50 per cent of the rainforest canopy being removed. Biologists have studied the effects of this logging on three ringtail possum species that live in the rainforest.

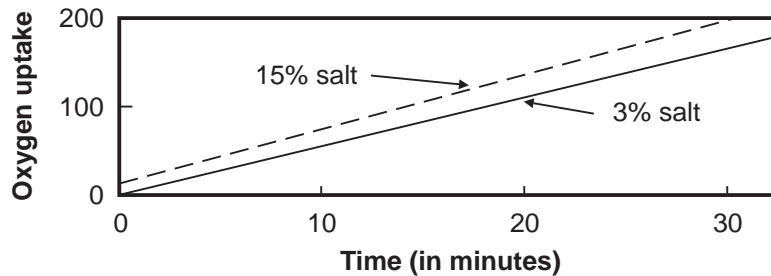
Green ringtail possum	<i>Pseudocheirus archeri</i> – a solitary animal that lives in the canopy of Strangler Fig trees. Its diet includes fruits of the fig trees. The Strangler Fig tree is not sought by loggers.
Herbert River ringtail possum	<i>P. herbertensis</i> – a canopy dweller that is generally a solitary animal. It lives in a "den" made from a hollow tree.
Lemuroid ringtail possum	<i>P. lemuroides</i> – a canopy dweller that lives in family groups. It is able to leap up to 2 metres from one branch to another. It is usually reluctant to come down to the ground.

On the basis of the information provided, predict which species is most likely to be affected by the selective logging of the timber. Give reasons for your prediction.

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(EBI)

Question 9

An investigator measured the amount of oxygen used by brine shrimp (small marine invertebrates) in a 3% salt solution and in a 15% salt solution. The results are presented in the graph below.



The investigator also made the following observations:

- Brine shrimp living in the 15% salt solution swam slightly less actively than those in the 3% salt solution.
- The animals grew somewhat less rapidly in the 15% salt solution.
- Females living in the 3% salt solution produced more eggs.

State a probable hypothesis that was being investigated.

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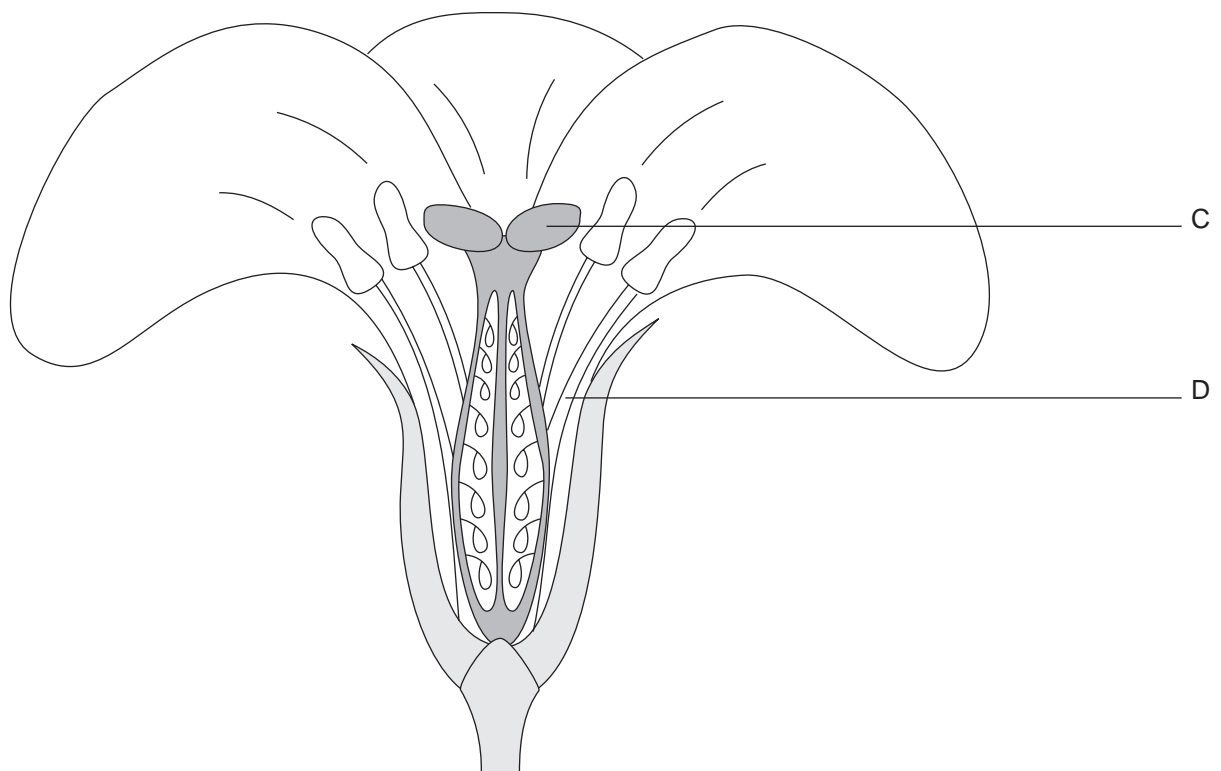
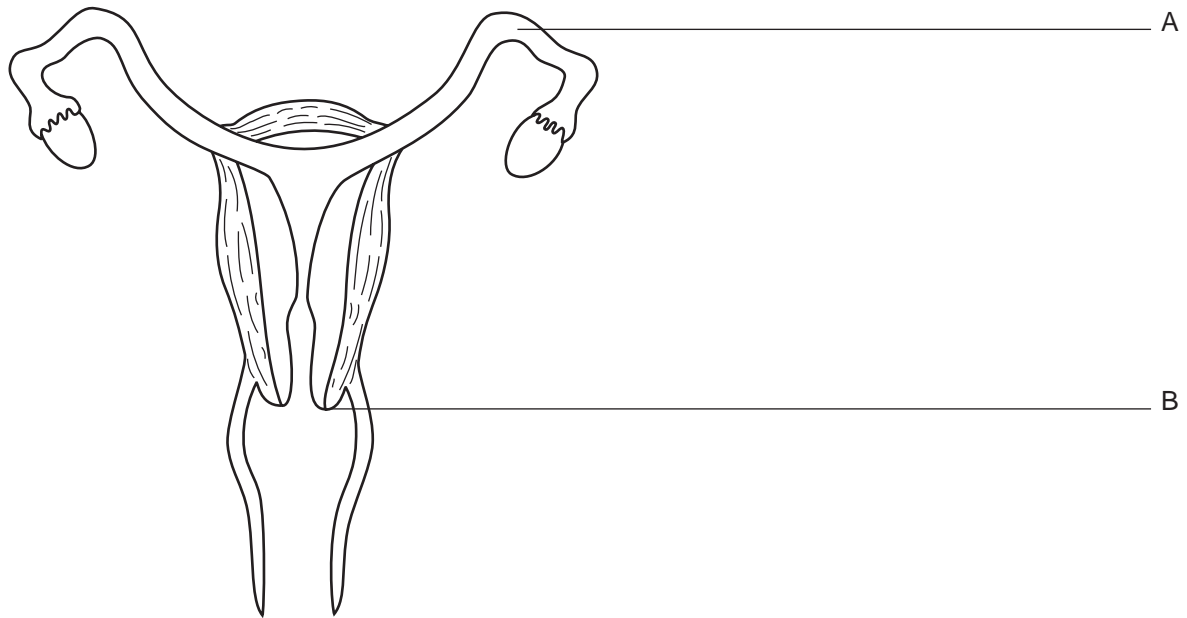
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(IB)

Question 10

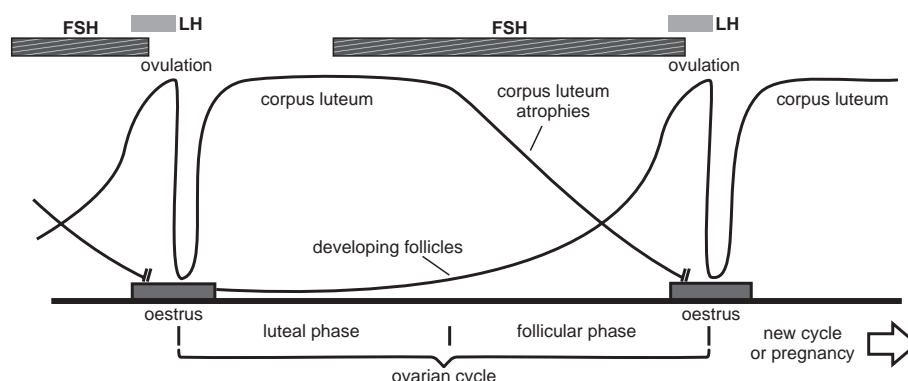
Label the structures marked A – D on the diagrams below of a female reproductive system and a flower.



(UB)

Question 11

The ovarian cycle in spontaneously ovulating mammals is shown below. The cycle can be divided into the luteal phase and the follicular phase which ends at ovulation.



Note: FSH = follicle stimulating hormone
LH = luteinising hormone

Use the information in the diagram to briefly state the role of the luteinising hormone (LH).

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(IB)

Question 12

Identify the two animals in the list below that are considered to be most closely related.

Common name	Scientific name
Fox	<i>Vulpes vulpes</i>
Indian elephant	<i>Elephas indicus</i>
Zebu	<i>Bos indicus</i>
African elephant	<i>Loxodonta africana</i>
Bull	<i>Bos taurus</i>
Dog	<i>Canis familiaris</i>

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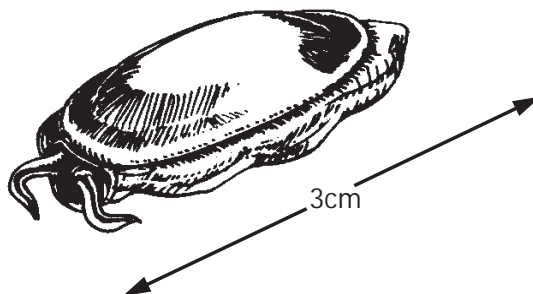
(UB)

Question 13

The information presented in the table below lists important characteristics of each of four phyla.

Phylum Annelida	marine, freshwater or terrestrial; bilaterally symmetrical; body internally and externally segmented; appendages either not jointed or lacking
Phylum Arthropoda	marine, freshwater or terrestrial; bilaterally symmetrical; body segmented but segments often fused; jointed appendages; jointed exoskeleton
Phylum Mollusca	marine, freshwater or terrestrial; bilaterally symmetrical or asymmetrical; usually a limy shell which may be external or internal; no segmentation
Phylum Echinodermata	all marine; adults radially symmetrical; radiating sections (where present) are called arms; internal limy skeletons

Use the information in the table to identify the animal, sketched below, found in a rock pool.



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(IB)

Question 14

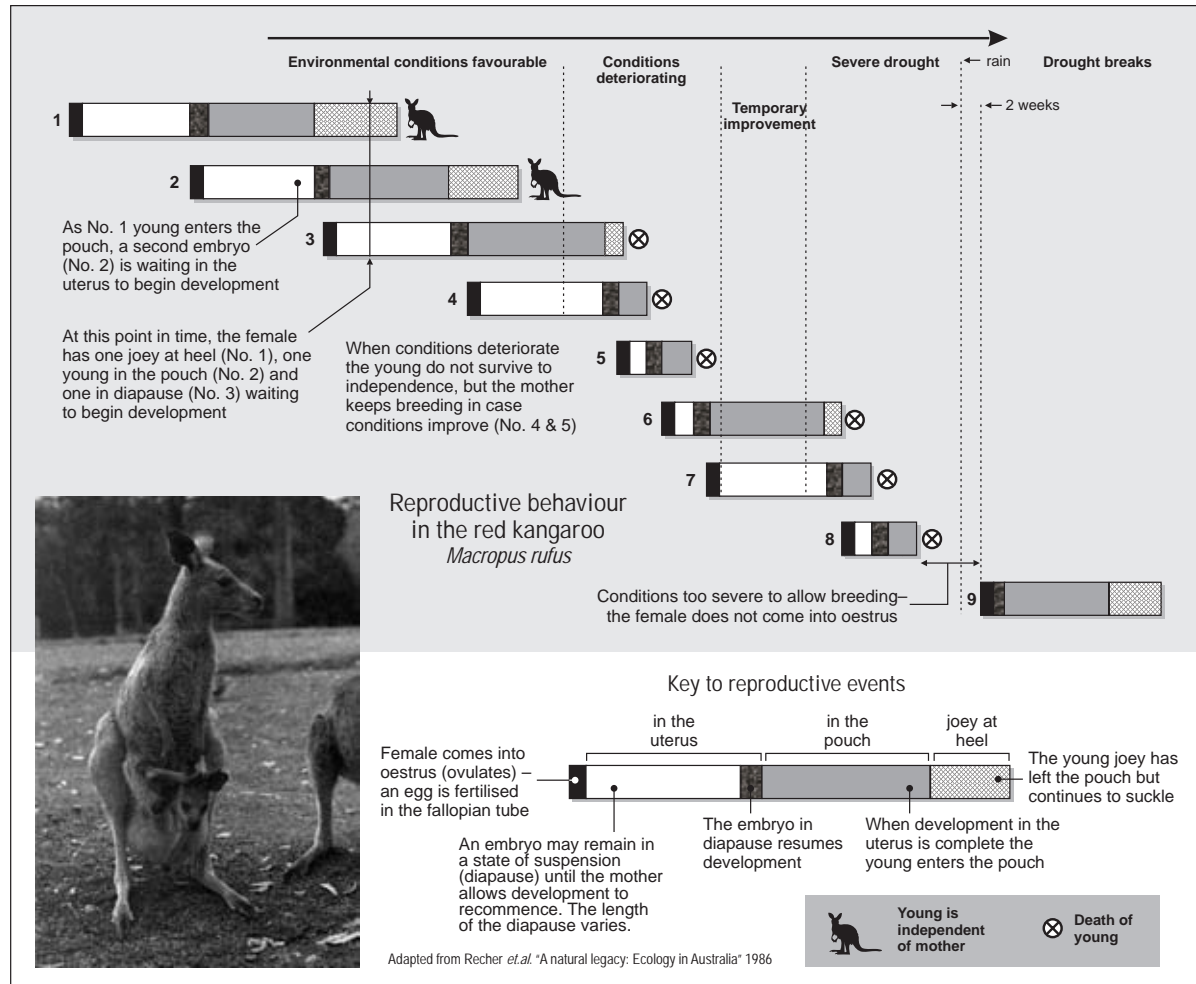
Jurassic Park, the popular movie about dinosaurs being bred on a remote island, was based on the use of ancient dinosaur blood (found entombed in the bowels of sucking insects trapped in tree sap that turned to amber stone), to isolate DNA and bring dinosaurs to life.

Give a plausible argument that may be offered against the use of this type of biotechnology by a scientist who believes that, while it can be done, it shouldn't be.

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(EBI)

Question 15

Some of Australia's mammals have developed reproductive strategies that allow them to make the most of brief periods of good conditions and survive periods of drought or starvation. The red kangaroo (*Macropus rufus*) is one of these. In good conditions it produces joeys in quick succession. The female may have a joey at heel, one in the pouch and a dormant embryo ready to replace the pouch offspring as soon as it leaves. The diagram below illustrates this pattern. The numbers indicate the offspring number, showing how the young develop through time.



When conditions deteriorate, the joey at heel perishes first, then the pouch young, then the diapausing embryo. Explain why the mother would withdraw nourishment in this order when times are hard.

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(IB)

Planning space

Planning space

Planning space

Standards associated with exit levels of achievement

	A	B	C	D	E
Understanding biology	<p>The candidate communicates understanding by:</p> <ul style="list-style-type: none"> 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. 	<p>The candidate communicates understanding by:</p> <ul style="list-style-type: none"> explaining ideas, concepts, principles and theories and describing interrelationships between them applying knowledge and understanding to a range of complex tasks. 	<p>The candidate communicates understanding by:</p> <ul style="list-style-type: none"> defining and describing ideas, concepts, principles and theories, and identifying interrelationships applying knowledge and understanding to a range of tasks. 	<p>The candidate communicates understanding by stating ideas and using terminology relevant to concepts and recalling interrelationships.</p>	<p>The candidate states terminology and ideas relevant to concepts.</p>
Investigating biology	<p>The candidate communicates investigative processes by:</p> <ul style="list-style-type: none"> 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. 	<p>The candidate communicates investigative processes by:</p> <ul style="list-style-type: none"> 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. 	<p>The candidate communicates investigative processes by:</p> <ul style="list-style-type: none"> 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. 	<p>The candidate communicates investigative processes by:</p> <ul style="list-style-type: none"> using data to answer questions designing an investigation which provides incomplete methodology and mentions variables attempting to organise data. 	<p>The candidate communicates investigative processes by providing incomplete methodology, and transcribes data.</p>

	A	B	C	D	E
Evaluating biological issues	<p>The candidate communicates by:</p> <ul style="list-style-type: none"> 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. 	<p>The candidate communicates by:</p> <ul style="list-style-type: none"> 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. 	<p>The candidate communicates by:</p> <ul style="list-style-type: none"> 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. 	<p>The candidate communicates by:</p> <ul style="list-style-type: none"> making statements related to source material making unsupported decisions recognising that a given issue has biological implications. 	<p>The candidate communicates by restating supplied information.</p>

Acknowledgments

Heinemann Educational Australia, a division of Reed International Books Australia Pty Ltd, Melbourne, and Barbara K. Evans, Pauline Y. Ladiges and John A. McKenzie for a graphic from *Biology One (Second Edition)*, *Organisms in their Environment: Functioning Organisms* by Barbara K. Evans, Pauline Y. Ladiges and John A. McKenzie, 1995. The graphic was originally published in *Physiology: A Regulatory Systems Approach* by F.L. Strand, published by MacMillan, 1978.

BIOZONE Learning Media Ltd, New Zealand, and Richard Allan for two diagrams, a graphic and a photograph published in *Year 11 Biology 1999: Student Resource and Activity Manual* (fifth edition) by Richard Allan and Tracey Greenwood, 1999. The graphic was originally published in *A natural legacy: Ecology in Australia* (second edition) by Harry F. Recher, Daniel Lunney and Irina Dunn, published by Pergamon Press, Sydney, 1986.

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