

**2006 BIOLOGY****FOR OFFICE
USE ONLY**

SUPERVISOR CHECK

**ATTACH SACE REGISTRATION NUMBER LABEL
TO THIS BOX****QUESTION
BOOKLET****1**

24 pages, 31 questions

Monday 13 November: 9 a.m.

Time: 3 hours

RE-MARKED

Section A and Part 1 of Section B

Examination material: Question Booklet 1 (24 pages)
Question Booklet 2 (13 pages)
one 8-page script book
one multiple-choice answer sheet
one SACE registration number label

*Approved dictionaries and calculators may be used.***Instructions to Students**

- You will have 10 minutes to read the paper. You must not write in your question booklets or script book, or on your multiple-choice answer sheet, or use a calculator during this reading time but you may make notes on the scribbling paper provided.
- This paper is in three sections: Section A and Part 1 of Section B are in Question Booklet 1; Part 2 of Section B and Section C are in Question Booklet 2.
Section A: Multiple-choice Questions (Questions 1 to 25)
Answer Section A on the separate multiple-choice answer sheet, using black or blue pen.
Answer *all* questions in Section A.
Section B: Short-answer Questions (Questions 26 to 37)
Answer Part 1 of Section B (Questions 26 to 31) in the spaces provided in Question Booklet 1.
Write on page 24 of Question Booklet 1 if you need more space.
Answer Part 2 of Section B (Questions 32 to 37) in the spaces provided in Question Booklet 2.
Write on page 12 of Question Booklet 2 if you need more space.
Section C: Extended-response Questions (Questions 38 and 39)
Answer *both* questions in Section C in the separate script book.
- In Section B there is no need to fill all the space provided; clear, well-expressed answers are required. If you delete part or all of an answer you should clearly indicate your final answer and label it with the appropriate question number.
- The allocation of marks and suggested allotment of time are as follows:

Section A	50 marks	40 minutes
Section B	120 marks	110 minutes
Section C	30 marks	30 minutes
Total	200 marks	3 hours
- Attach your SACE registration number label to the box at the top of this page. Copy the information from your SACE registration number label into the boxes on your multiple-choice answer sheet and on the front covers of Question Booklet 2 and your script book.
- At the end of the examination, place Question Booklet 2, your script book, and your multiple-choice answer sheet inside the back cover of Question Booklet 1.

STUDENT'S DECLARATION ON THE USE OF CALCULATORS

By signing the examination attendance roll I declare that:

- my calculators have been cleared of all memory;
- no external storage media are in use on these calculators.

I understand that if I do not comply with the above conditions for the use of calculators I will:

- be in breach of the rules;
- receive zero marks for the examination;
- be liable to such further penalty, whether by exclusion from future examinations or otherwise, as SSABSA determines.

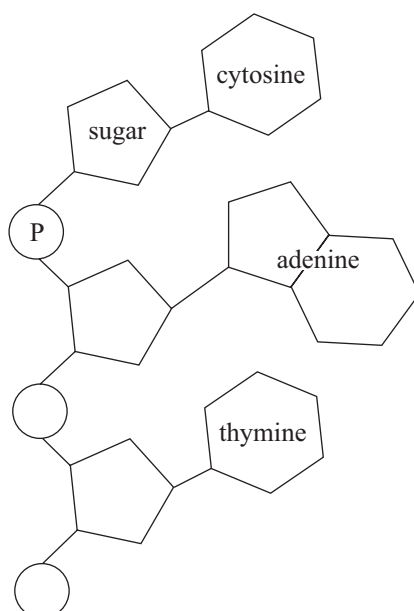
SECTION A: MULTIPLE-CHOICE QUESTIONS (Questions 1 to 25)

(50 marks)

Answer **all** questions in this section.

Each of the twenty-five multiple-choice questions in Section A involves choosing from four alternative answers. Read each question carefully. Then indicate the **one** alternative that you consider best answers the question by shading the bubble by the appropriate letter alongside the question number on the multiple-choice answer sheet. Use black or blue pen. It is in your interest to give an answer to every question in this section of the paper, as no marks are deducted for incorrect answers. Each question is worth 2 marks. You should spend about 40 minutes on this section.

1. Refer to the following diagram, which shows part of a nucleic acid:



Which one of the following statements is correct?

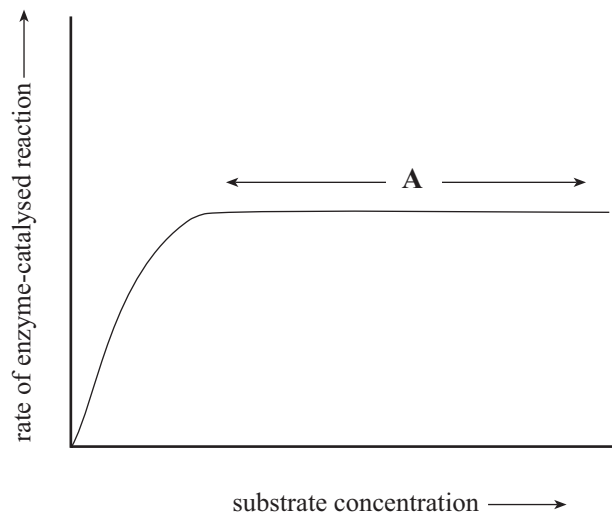
The diagram represents part of

- J. a DNA molecule, because only DNA contains adenine.
- K. an RNA molecule, because only RNA contains thymine.
- L. a DNA molecule, because only DNA contains thymine.
- M. an RNA molecule, because only RNA contains adenine.

2. Chitin is a

- J. polysaccharide found in the cell walls of some fungi.
- K. phospholipid found in the cell membranes of animals.
- L. polysaccharide that is an energy reserve in animals.
- M. phospholipid that is an energy reserve in plants.

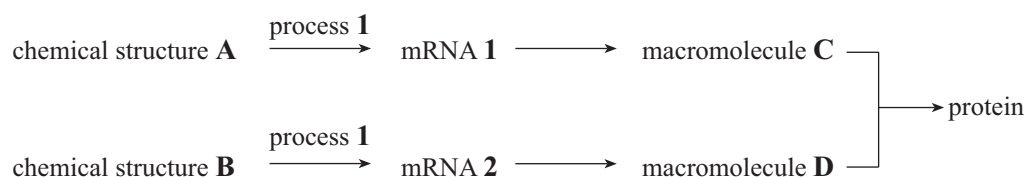
3. Refer to the following graph, which shows the results of an experiment to determine the effect of varying the substrate concentration on the rate of an enzyme-catalysed reaction. The experiment was conducted at the optimum pH for the enzyme and in the presence of an inhibitor:



The rate of the enzyme-catalysed reaction in the section labelled **A** on the graph could be higher if

- J. the substrate concentration was increased.
- K. the pH was increased.
- L. the enzyme concentration was decreased.
- M. the inhibitor concentration was decreased.

4. Refer to the following diagram, which shows some of the steps involved in the manufacture of a protein in a eukaryotic cell:



Which one of the following combinations correctly matches the name of chemical structure A, the location of process 1, and the name of macromolecule D?

	Name of chemical structure A	Location of process 1	Name of macromolecule D
J.	gene	nucleus	amino acid
K.	amino acid	cytoplasm	polypeptide
L.	polypeptide	cytoplasm	amino acid
M.	gene	nucleus	polypeptide

5. Refer to the following table, which shows some of the mRNA codons for some amino acids:

mRNA codon	Amino acid
AUG	methionine
AAG	lysine
GGC, GGU	glycine
UUU, UUA	phenylalanine
AUA	isoleucine
UAA, UAG	stop

A section of mRNA has the following codons:

codon number	.....	51	52	53	54	55	.....
mRNA codon	.....	GGC	AAG	UUU	AUA	AAG	.....

Which one of the following changes to the mRNA section shown above would **not** result in the production of a different protein?

- J. The deletion of the third U in codon 53.
- K. The substitution of U for the second A in codon 52.
- L. The insertion of U between codons 51 and 52.
- M. The substitution of U for C in codon 51.

6. The activation energy for a chemical reaction
- J. is increased by the presence of an enzyme.
 - K. is the energy released by the chemical reaction.
 - L. helps to form new chemical bonds in the products.
 - M. helps to break chemical bonds in the reactants.

7. Which one of the following combinations correctly identifies a cellular structure, its function, and the type of cell in which it is found?

	Cellular structure	Function	Type of cell in which it is found
J.	circular loop of DNA	contains information for the synthesis of proteins	eukaryotic
K.	ribosome	the site of protein synthesis	prokaryotic
L.	linear DNA	contains information for the synthesis of mRNA molecules	prokaryotic
M.	endoplasmic reticulum	the site for the packaging and secretion of proteins	eukaryotic

8. Red blood cells have an internal solute concentration equivalent to that of a 2% sucrose solution. The membranes of red blood cells are impermeable to sucrose, but permeable to water.

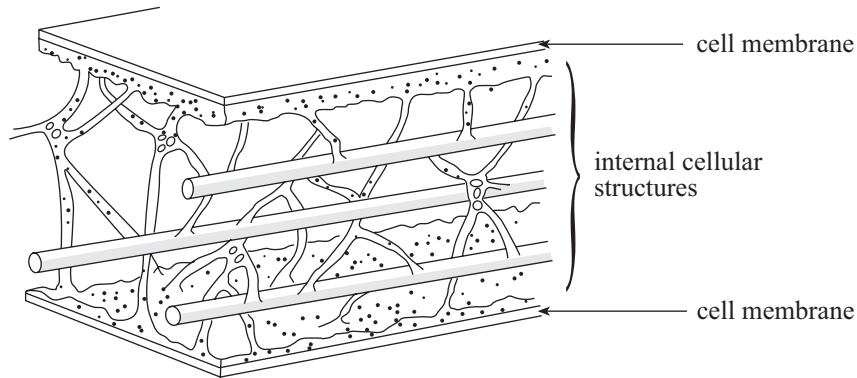
If red blood cells are placed in a 10% sucrose solution they will show

- J. an increase in mass and an increase in surface area to volume ratio.
 - K. a decrease in mass and an increase in surface area to volume ratio.
 - L. an increase in mass and a decrease in surface area to volume ratio.
 - M. a decrease in mass and a decrease in surface area to volume ratio.
9. Unlike many other land plants, mosses are able to grow in soil that has a high salt concentration. Moss cells are able to maintain a low internal sodium ion concentration even when the moss is watered with salt water.

Which one of the following mechanisms would enable moss cells to maintain a low internal sodium ion concentration even when the moss is watered with salt water?

- J. The removal of water by osmosis.
- K. The uptake of sodium ions by diffusion.
- L. The uptake of water by endocytosis.
- M. The removal of sodium ions by active transport.

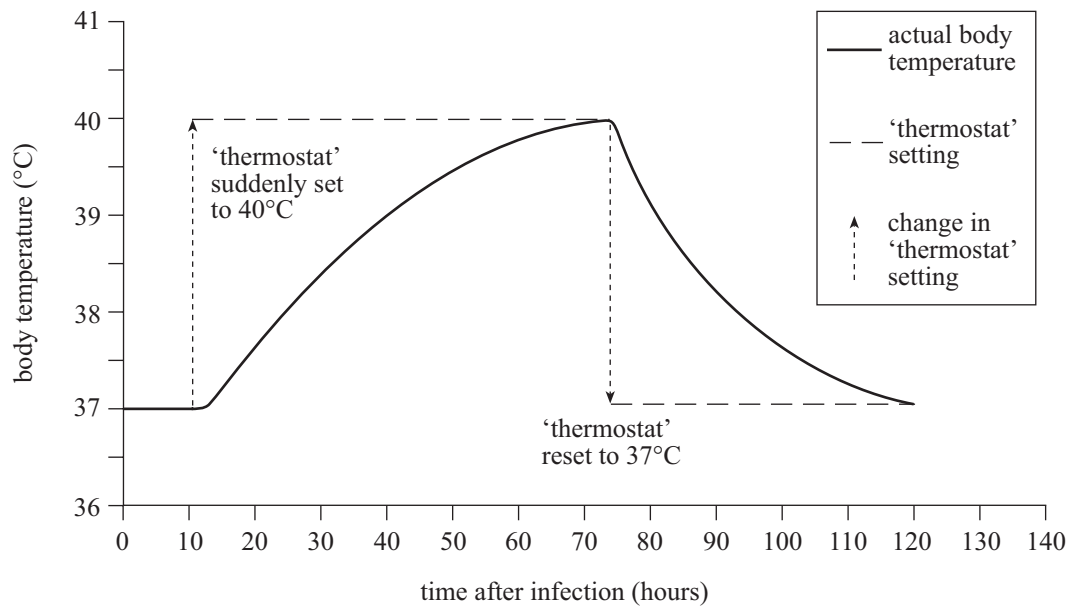
10. Refer to the following diagram, which represents some internal cellular structures found in eukaryotic cells:



The internal cellular structures shown in the diagram are directly involved with

- J. the movement of large molecules into a cell by active transport.
 - K. a change of cell shape using energy from ADP.
 - L. the movement of the cell membrane during exocytosis.
 - M. the separation of homologous chromosomes during mitosis.
11. Which one of the following structures is present in eukaryotic cells and provides the best evidence for endosymbiosis?
- J. A nucleus.
 - K. Folded membranes of endoplasmic reticulum.
 - L. Linear DNA molecules in chloroplasts.
 - M. Double membranes around mitochondria.
12. Which one of the following statements about the cell membrane is correct?
- J. Some small molecules move passively between the phospholipid molecules.
 - K. Cellulose molecules act as receptors on the membrane surface.
 - L. Some molecules move passively through the membrane against the concentration gradient.
 - M. Phospholipid molecules are embedded in two layers of protein molecules.

13. Refer to the following graph, which shows the changes in body temperature of a human being during the first 120 hours of a bacterial infection:



During a bacterial infection, white blood cells release a protein which changes the set point of the brain 'thermostat' from 37°C to 40°C. When this protein breaks down after about 3 days, the brain 'thermostat' is reset to 37°C.

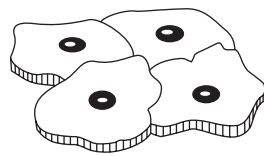
Which one of the following responses is most likely to occur?

- J. A decrease in thyroxine production between 10 and 70 hours after the onset of the infection.
 - K. Shivering 40 hours after the onset of the infection, when the body temperature is about 39°C.
 - L. A decrease in metabolic activity between 10 and 70 hours after the onset of the infection.
 - M. A decrease in sweating 80 hours after the onset of the infection, when the body temperature is about 39°C.
14. Tea and coffee contain caffeine, which increases the volume of urine produced by the kidneys.

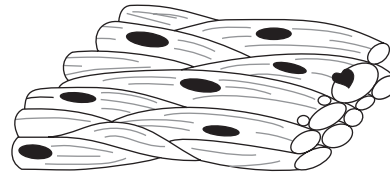
The most likely response of the nephrons in the kidney to caffeine would be to **decrease** the rate of

- J. active transport of sodium ions into the tubule from the blood capillaries.
- K. filtration at the glomerulus.
- L. reabsorption of sodium ions into the blood capillaries from the tubule.
- M. active transport of urea into the tubule from the blood capillaries.

15. Refer to the following diagrams, which illustrate epithelial cells and smooth muscle cells from the same human body:



epithelial cells

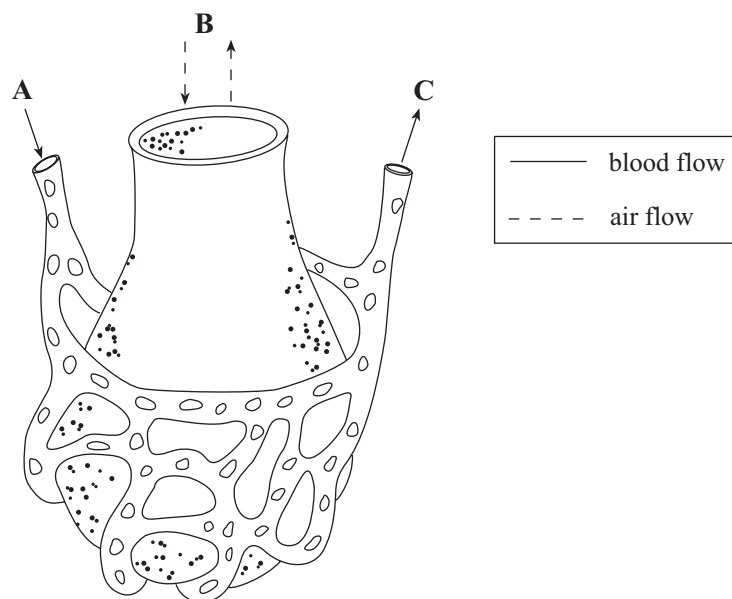


smooth muscle cells

These smooth muscle cells have

- J. identical genes to, and different functions from, these epithelial cells.
- K. different genes from, and similar functions to, these epithelial cells.
- L. different genes from, and different functions from, these epithelial cells.
- M. identical genes to, and similar functions to, these epithelial cells.

16. Refer to the following diagram, which represents an alveolus and its blood supply:



Which one of the following statements is *incorrect*?

- J. The blood at **A** would have a higher concentration of oxygen than the blood at **C**.
- K. The air entering and leaving the alveolus at **B** will have a higher concentration of oxygen and a lower concentration of carbon dioxide than the blood in the capillaries.
- L. The blood at **C** would have a lower concentration of carbon dioxide than the blood at **A**.
- M. The continual movement of blood from **A** to **C** helps to maintain a concentration gradient for oxygen and carbon dioxide between the alveolus and the capillaries.

17. 'Crossing over' and 'independent assortment of chromosomes' occur during

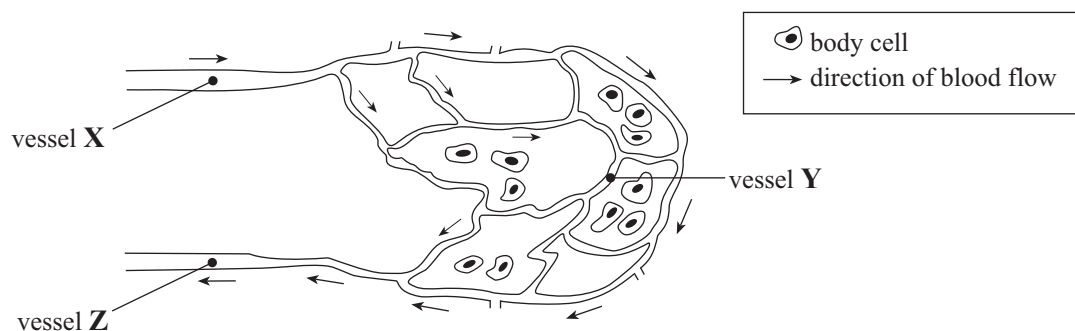
- J. mitosis leading to the formation of diploid cells.
- K. meiosis leading to the formation of haploid cells.
- L. meiosis leading to the formation of diploid cells.
- M. mitosis leading to the formation of haploid cells.

18. A person detects the smell of hot food in the air as he passes a restaurant. Shortly afterwards he notices that the amount of saliva in his mouth has increased considerably.

Which one of the following statements is correct?

- J. The smell of hot food is the sensor and the brain is the effector.
- K. The smell of hot food is the receptor and the nasal mucous membranes are the effectors.
- L. The smell of hot food is the reflex and the central nervous system is the effector.
- M. The smell of hot food is the stimulus and the salivary glands are the effectors.

19. Refer to the following diagram, which shows a network of blood vessels in the human body:



It would be reasonable to conclude that

- J. the blood pressure in vessel Z is greater than the blood pressure in vessel X.
- K. glucose moves more readily out of vessel Y than out of vessel X.
- L. protein concentration is greater in vessel X than in vessel Z.
- M. carbon dioxide diffuses more readily into vessel X than into vessel Y.

20. Which one of the following statements about natural selection is *incorrect*?

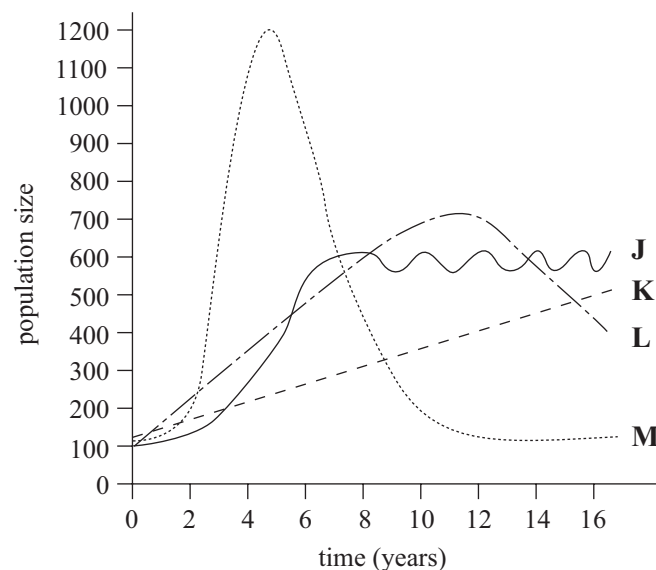
Natural selection may

- J. result in an increase in the percentage of well-adapted individuals in a population.
- K. cause new genes to appear in a gene pool.
- L. result in an increase in the frequency of favourable genes in a gene pool.
- M. occur in stable environmental conditions.

21. Which one of the following mechanisms will *not* help to maintain the reproductive isolation of different species in a community?

- J. Different mating behaviours and courting rituals.
- K. Anatomical differences in the genitals of the different species.
- L. Similar habitat preferences within a community.
- M. Gametes unable to fuse successfully to produce a zygote.

22. Refer to the following graphs, **J**, **K**, **L**, and **M**, which show the changes in the population size of four bird species over 16 years:



Which graph describes the population changes for a bird species that lives in a community where resources are abundant, allowing the population to increase until the carrying capacity is reached?

- J. Graph **J**.
- K. Graph **K**.
- L. Graph **L**.
- M. Graph **M**.

23. Grass responds very quickly to rainfall, sending up green shoots within 24 to 48 hours. Australian plague locusts (*Chortoicetes terminifera*) feed on these shoots and are able to mature and lay eggs within 5 to 7 days.

During summer, if grass remains green, female locusts will lay up to 150 eggs every 5 days. Between summer and winter, in ideal conditions, it is possible to have four generations of locusts. Locusts provide no parental care.

Which region on the continuum below best represents the reproductive strategy that the Australian plague locust uses?

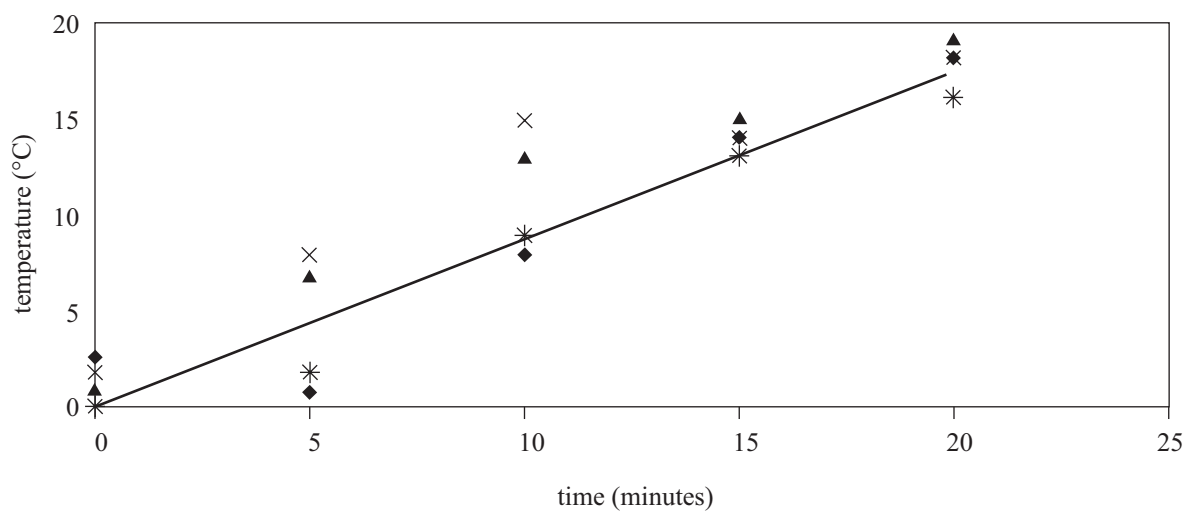


- J. Region A.
 - K. Region B.
 - L. Region C.
 - M. Region D.
24. An ecologist designed an experiment to investigate the effects of land use on plant size and diversity. She recorded tree height, species diversity, and the distribution of species on current farmland, on abandoned farmland, and on land that had never been farmed.

The independent variable in this experiment was

- J. tree height.
- K. distribution of species.
- L. type of land use.
- M. area of land sampled.

25. Refer to the following graph, which shows the measurements taken by four students at five-minute intervals during the same experiment. Each student's measurements were recorded with a different symbol (\times , \blacktriangle , \blacklozenge , $*$).



The measurements taken at 5 minutes show

- J. a higher level of accuracy than the measurements taken at 15 minutes.
- K. a higher level of resolution than the measurements taken at 15 minutes.
- L. a lower level of precision than the measurements taken at 15 minutes.
- M. a lower level of systematic error than the measurements taken at 15 minutes.

SECTION B: SHORT-ANSWER QUESTIONS (Questions 26 to 37)

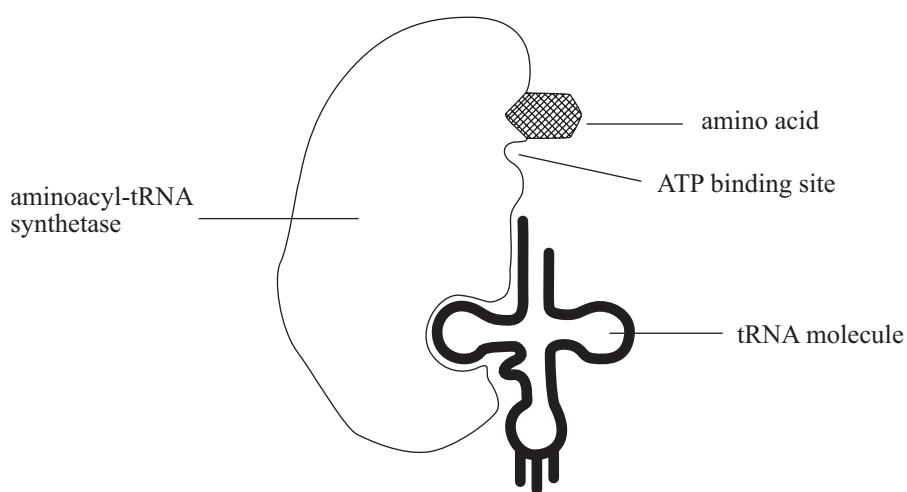
(120 marks)

*You should spend about 110 minutes on this section. Answers may be in note form. The allocation of marks is shown in brackets at the end of each part of each question. Answer **all** questions in the spaces provided.*

Part 1 (Questions 26 to 31)

(60 marks)

26. Refer to the following diagram, which shows the enzyme aminoacyl-tRNA synthetase binding to a tRNA molecule and an amino acid. The enzyme also has a binding site for ATP:



- (a) Name the process during protein synthesis in which tRNA molecules transport amino acids to the ribosomes.

_____ (2 marks)

- (b) Aminoacyl-tRNA synthetase matches a specific amino acid to its tRNA molecule.

- (i) The tRNA molecule with the anticodon CUA is matched with the amino acid aspartic acid.

State the **DNA** base triplet that codes for aspartic acid.

_____ (2 marks)

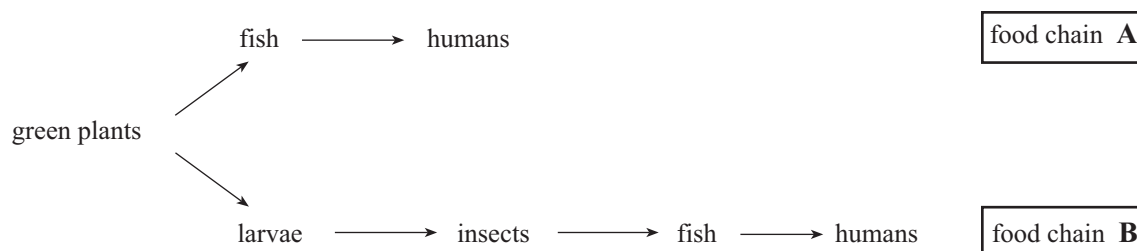
- (ii) Explain why each different aminoacyl-tRNA synthetase enzyme can only match one specific amino acid ***and not other amino acids*** to its tRNA molecule.

(4 marks)

- (c) State why it is necessary for ATP to bind to the ATP binding site on the enzyme before an amino acid can bind to its specific tRNA molecule.

(2 marks)

27. Refer to the diagram below, which shows two food chains that allow the energy stored in green plants to be passed on to humans:



- (a) Explain why more energy is available to humans through food chain **A** than through food chain **B**.

(4 marks)

- (b) Decomposers have not been shown in these food chains.
State the importance of decomposers to a community.

(2 marks)

28. The increasing salinity of agricultural soils is a major environmental problem in Australia. Cereal crops, such as barley and wheat, do not grow well in soils with high levels of salt. Moss, however, has a salt-tolerance gene that enables it to grow well in salty soils.

Genetic engineers are investigating ways of modifying cereal plants to make the plants more salt-tolerant.

- (a) State one advantage to farmers of modifying cereal plants to enable the plants to grow in salty soils.

(2 marks)

- (b) The bacterium *Agrobacterium tumefaciens* can be used to genetically engineer cereal plants.

Describe how bacterial plasmids may be used to **transfer** the salt-tolerance gene from moss to a cereal plant.

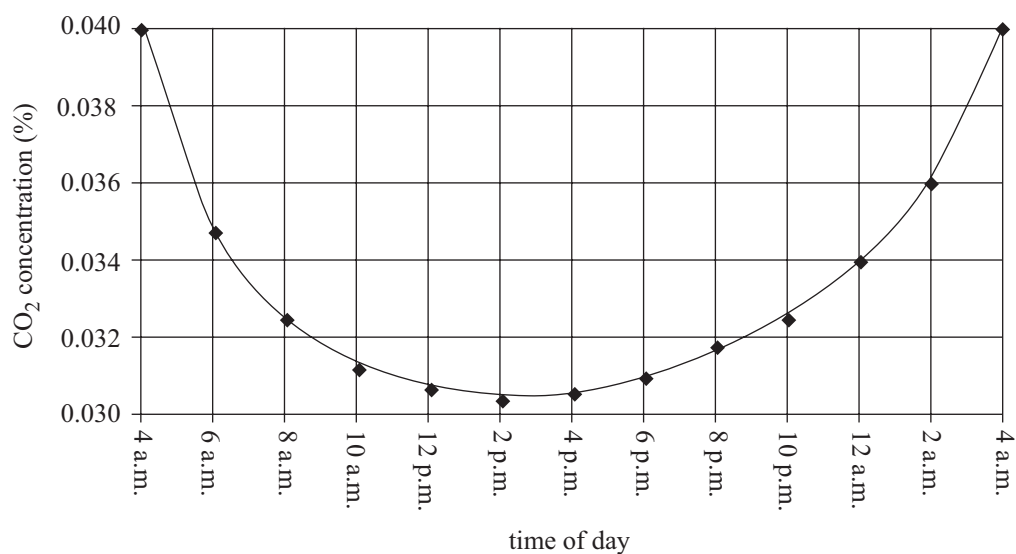
(4 marks)

- (c) Bacterial plasmids can also be used to make identical copies of the salt-tolerance gene through semi-conservative replication.

Explain how semi-conservative replication produces genetically identical copies of DNA.

(4 marks)

29. Refer to the following graph, which shows daily changes in CO_2 concentration one metre above a plant crop:



(a) Describe the pattern of results shown in the graph above.

(4 marks)

(b) Explain why the CO_2 concentration one metre above the plant crop changes between 4 a.m. and 2 p.m.

(4 marks)

(c) Explain why heterotrophs are dependent on the autotrophs in the biosphere.

(4 marks)

30. Vivitrol, a drug that blocks certain pleasure receptors in the brain, has recently been released on the American market to treat alcoholics. Prior to the drug being released, an experiment was done to verify its ability to reduce the pleasurable effect of alcohol. This experiment was repeated in more than twenty countries to verify the results.

(a) State one *other* reason why it is necessary to repeat an experiment.

(2 marks)

(b) In each country, the experiment involved testing the effect of Vivitrol on many people. Some people were given the drug while others were given a placebo, a substance that is known to have no effect on the pleasure receptors for alcohol. None of the people knew whether they were given the drug or the placebo.

(i) State why it was necessary to test the effect of Vivitrol on many people in each country.

(2 marks)

(ii) State why it was necessary to give a placebo to some of the people being tested.

(2 marks)

- (c) State one benefit to society of a government subsidy of the cost of Vivitrol for alcoholics.

(2 marks)

31. Erythropoietin (EPO) is a protein hormone produced by normal human kidney cells. EPO stimulates bone marrow cells to divide, producing oxygen-carrying red blood cells.

- (a) By referring to the structure of the cell membrane, explain why EPO can stimulate bone marrow cells *but not all cells* to divide.

(4 marks)

- (b) People with kidney disease may produce abnormally low levels of EPO. They are treated with injections of additional EPO. The source of this additional EPO is recombinant EPO (rEPO) which is produced from cell cultures of hamster cancer cells that have been genetically engineered to contain the human EPO gene.

- (i) State why it is important to consider temperature when culturing hamster cancer cells in order to maximise the production of rEPO.

(2 marks)

- (ii) State why it is necessary for the culture medium to contain amino acids.

(2 marks)

- (c) Athletes can increase their red blood cell count by injecting rEPO. One study found that an increase in the red blood cell count resulted in an 8% increase in an athlete's aerobic performance.

Explain how an increase in the red blood cell count could result in an increase in an athlete's aerobic performance.

(4 marks)

- (d) Athletes are not permitted to take performance-enhancing drugs. However, some drugs, like rEPO, are difficult to detect.

Drug-testing authorities have suggested that rEPO would be more easily detected if its chemical structure was altered slightly.

State one argument *against* altering the chemical structure of rEPO.

(2 marks)

[illegible]



2006 BIOLOGY

SACE REGISTRATION NUMBER							
SEQ	FIGURES					CHECK LETTER	BIN
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
BIOLOGY							

**QUESTION
BOOKLET****2**

13 pages, 8 questions

Monday 13 November: 9 a.m.**Part 2 of Section B, and Section C**

*Write your answers to Part 2 of Section B in this question booklet.
Write your answers to Section C in the separate script book.*

SSABSA

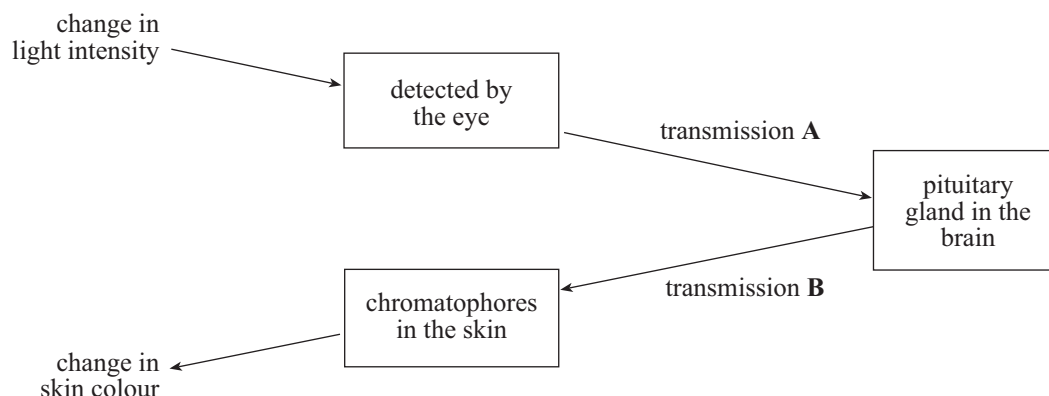
SECTION B: SHORT-ANSWER QUESTIONS

Part 2 (Questions 32 to 37)

(60 marks)

Answer **all** questions in the spaces provided.

32. Refer to the following diagram, which shows how some fish and amphibians alter their skin colour in response to a change in the light intensity of their surroundings:



Chromatophores are cells in the skin that contain pigments that alter skin colour.

Experimentation has shown that:

- cutting the nerves from the brain to the skin does not prevent a change in skin colour in response to a change in light intensity;
- cutting the nerves from the eye to the brain prevents a change in skin colour in response to a change in light intensity.

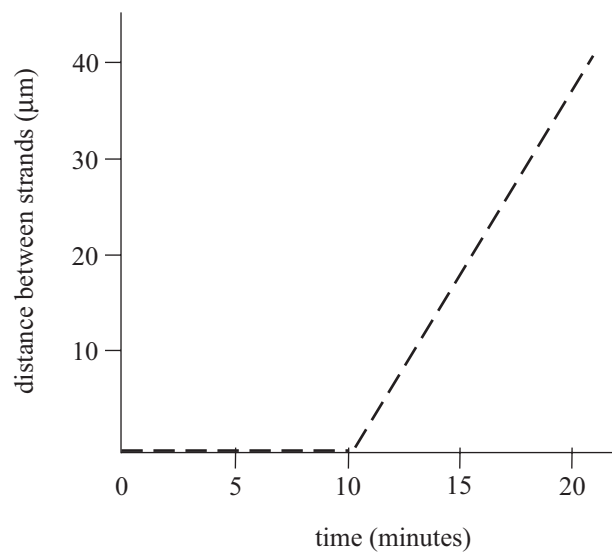
Explain why the speed of transmission **A** is different from the speed of transmission **B**.

(4 marks)

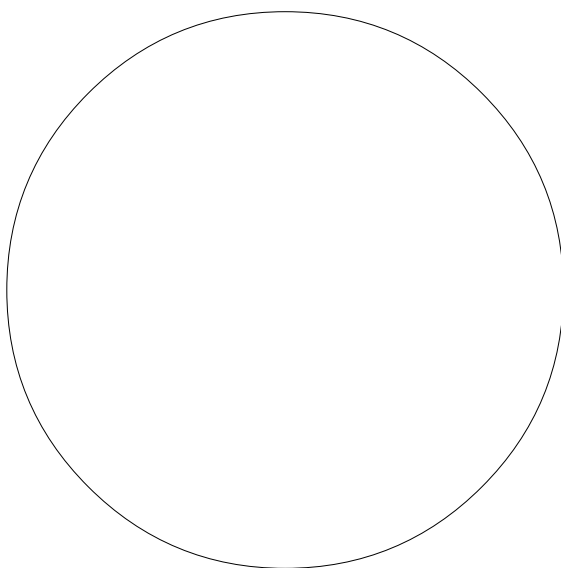
33. (a) State why DNA needs to be replicated prior to mitotic cell division.

(2 marks)

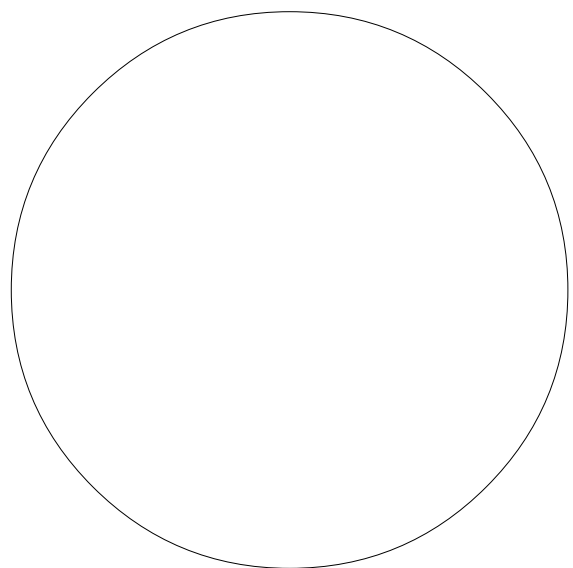
(b) Refer to the following graph, which shows the distance between the sister chromatids of a replicated chromosome during a mitotic cell division:



Draw diagrams to show the arrangement of the chromosomes at 10 minutes and at 20 minutes in a diploid cell containing four chromosomes.



Pattern at 10 minutes



Pattern at 20 minutes
(4 marks)

- (c) Paclitaxel is a drug that interferes with the separation of sister chromatids.
Explain why paclitaxel can be used to treat some cancers.

(4 marks)

34. Refer to the following diagrams, which show the results of an experiment used to investigate the mutation rate of the bacterium *Salmonella*:

Diagram 1

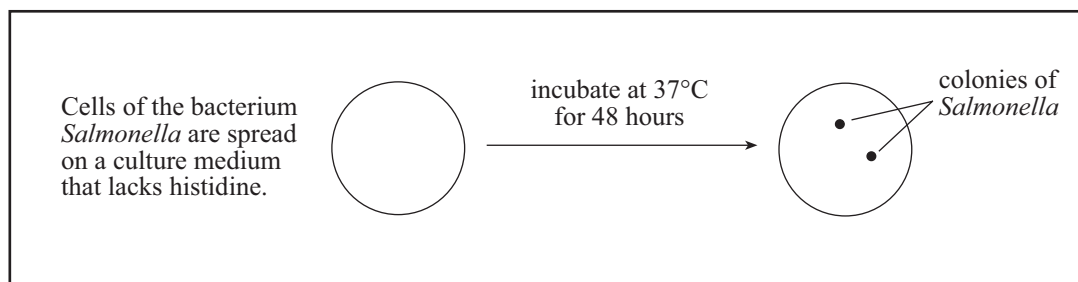
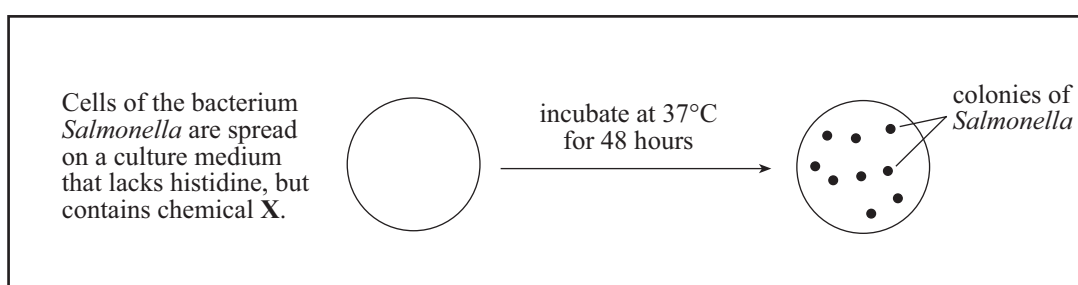


Diagram 2



Salmonella is normally unable to synthesise the amino acid histidine and therefore does not grow on a culture medium that lacks histidine. The colonies of *Salmonella* that do grow on this medium have a mutation that enables the bacteria to synthesise histidine.

The first part of the experiment involved growing colonies of *Salmonella* on a culture medium that lacked histidine. The result of the first part of the experiment is shown in diagram 1.

In the second part of the experiment, chemical X was mixed with the same culture medium. The result of this part of the experiment is shown in diagram 2.

- (a) State *one* possible hypothesis being tested in this experiment.

(2 marks)

- (b) State the dependent variable in this experiment.

(2 marks)

(c) State one systematic error that could affect the results of this experiment.

_____ (2 marks)

(d) State why it can be concluded that chemical **X** is a mutagenic chemical.

_____ (2 marks)

(e) Name two factors, other than mutagenic chemicals, that increase mutation rate.

(i) _____ (1 mark)

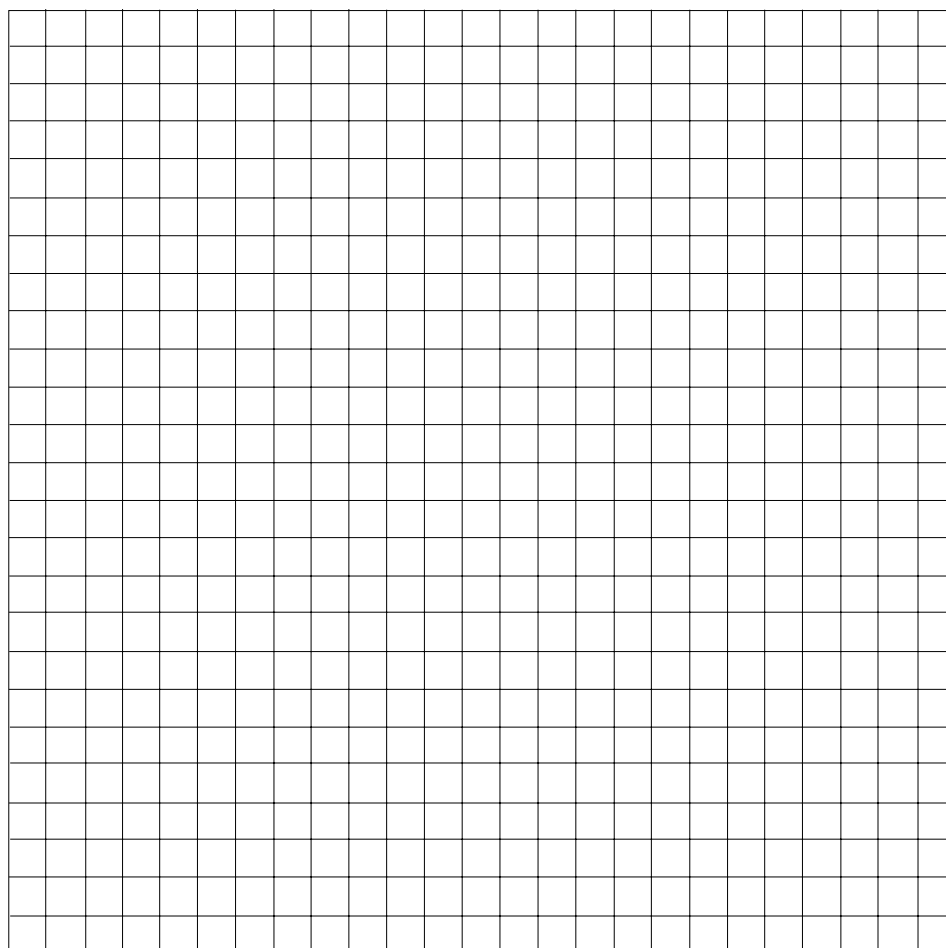
(ii) _____ (1 mark)

35. Refer to the following table, which shows the population sizes of plant species 1, plant species 2, and animal species A in a forest community in the six years after a bushfire in 1999:

	Population size					
Year	2000	2001	2002	2003	2004	2005
Plant 1	80	62	23	4	0	0
Plant 2	0	5	20	95	110	50
Animal A	0	0	0	5	25	16

- (a) Graph the data for plant 1, plant 2, and animal A from 2000 to 2005 on the grid below using the same axes. Clearly label each line.

Plant and animal population sizes in the six years after a bushfire



(6 marks)

(b) Define the ecological term 'community'.

(2 marks)

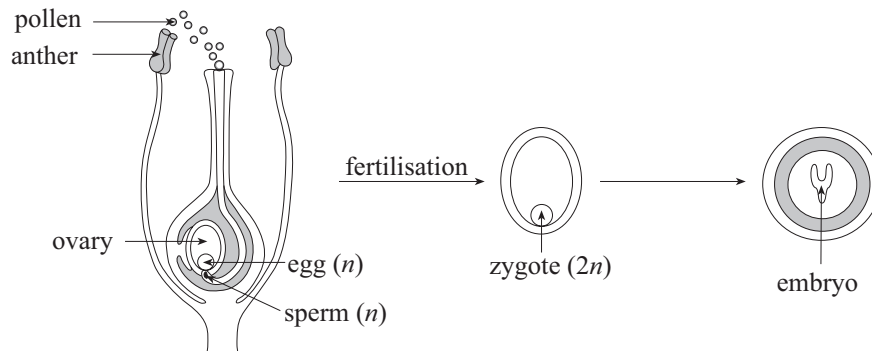
(c) Explain *one* possible reason why plant **1** must be established in the community before plant **2** can begin to grow.

(4 marks)

(d) Using the data in the table, explain *one* possible relationship between plant **2** and animal **A**.

(4 marks)

36. Refer to the following diagrams, which show the male and female parts of a flower, the formation of a zygote, and the formation of an embryo. Pollen grains, which are made in the anther, carry sperm; eggs are made in the ovary:



- (a) Name the type of nuclear division that results in the formation of sperm in the anther and the formation of eggs in the ovary.

_____ (2 marks)

- (b) State the importance of fertilisation.

_____ (2 marks)

- (c) Name the type of cell division that results in the formation of the embryo from the zygote.

_____ (2 marks)

- (d) Self-incompatibility is the ability of the flowers of some species to reject their own pollen and the pollen of closely related individuals in favour of pollen from less closely related individuals.

Explain why self-incompatibility is an advantage for a plant species.

_____ (4 marks)

37. The transport of nutrients from the small intestine into intestinal epithelial cells can be affected by chemical exposure and disease.

- (a) In human beings, the rate of transport of glucose from the small intestine into intestinal epithelial cells can be reduced by inhibitors of enzymes involved in cellular respiration.

Explain how the effect of these inhibitors suggests that glucose is taken into the intestinal epithelial cells by active transport.

(4 marks)

- (b) Describe the role of cellular membranes in the process of exocytosis.

(4 marks)

- (c) Coeliac disease results in the destruction of intestinal villi.

State why the destruction of intestinal villi decreases amino acid absorption.

(2 marks)

[illegible]

SECTION C: EXTENDED-RESPONSE QUESTIONS (Questions 38 and 39)

(30 marks)

Answer **both** questions in this section.

Write your answers in the separate script book provided. **Begin each answer on a new page.**

You should spend about 30 minutes on this section, 5 to 10 minutes planning and 20 to 25 minutes writing. Credit will be given for clear, well-expressed answers that are well organised and relevant to the questions.

38. The cell cycle is controlled by internal and external factors. Some of these factors are gene products, which require energy in order to be synthesised.

Describe:

- the role of at least one internal and at least one external factor in controlling the cell cycle;
- cellular processes that use glucose to provide the ATP that is needed to synthesise gene products.

(15 marks)

39. Leafy sea dragons, *Phycodurus eques*, are found in the kelp forests in the sea off South Australia. The leafy sea dragon is closely related to the sea horse and the pipefish.

Leafy sea dragons feed on larval fish and small crustaceans. The small crustaceans feed on the red algae found in the kelp forests.

In the past, the high demand for leafy sea dragons as an aquarium species led to their near extinction. Leafy sea dragons are now protected under the *Commonwealth's Environment Protection and Biodiversity Conservation Act 1999*.

Describe:

- **one** method that could be used by scientists to determine whether the leafy sea dragon is more closely related to the sea horse or to the pipefish;
- the importance to the kelp forest community of protecting the leafy sea dragon;
- **two** advantages of protecting the kelp forests rather than protecting only the leafy sea dragon.

(15 marks)