Rewarding Learning

Centre Number	
71	

Candidate Number

ADVANCED
General Certificate of Education
January 2010

Biology

Assessment Unit A2 1

assessing

Physiology and Ecosystems

[AB211]

AB211

MONDAY 25 JANUARY, AFTERNOON

TIME

2 hours.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Write your answer to Section B on the lined paper at the end of this booklet.
Answer **all nine** questions.
You are provided with **Photograph 4.4** for use with Question **4** in this paper.
Do not write your answers on this photograph.

INFORMATION FOR CANDIDATES

The total mark for this paper is 90.
Section A carries 72 marks. Section B carries 18 marks.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
You are reminded of the need for good English and clear presentation in your answers.
Use accurate scientific terminology in all answers.
You should spend approximately **25 minutes** on Section B.
You are expected to answer Section B in continuous prose.
Quality of written communication will be assessed in **Section B** and awarded a maximum of 2 marks.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total Marks	

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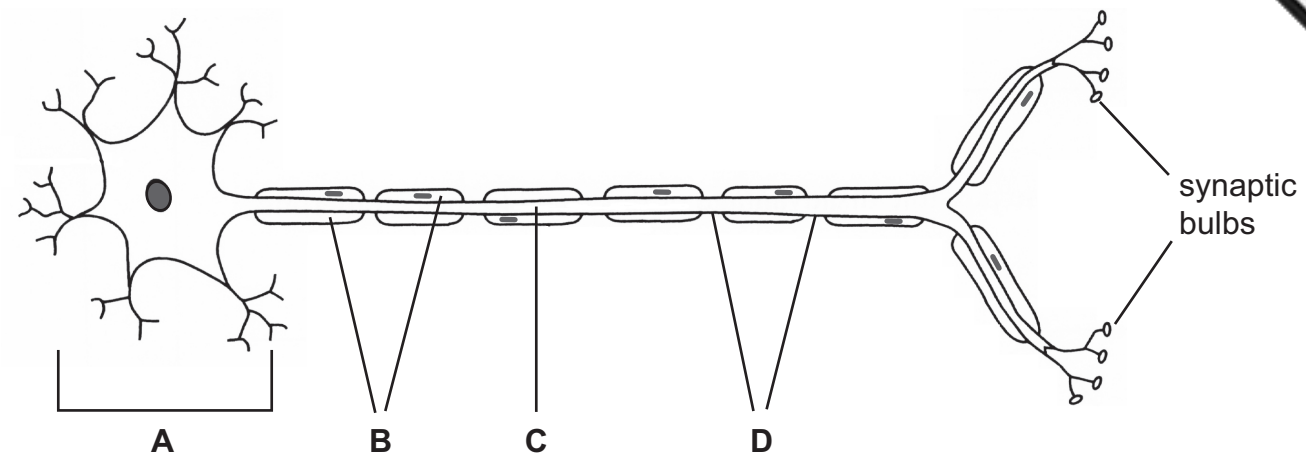
Section A

1 The diagram below represents the structure of a neurone.



Examiner Only	
Marks	Remark

(a) Identify the structures labelled **A** to **D**.

A _____

B _____

C _____

D _____ [3]

(b) Draw an arrow **on the diagram** above to indicate the direction of a nerve impulse travelling along the neurone. [1]

(c) Explain why the neurone shown above might be expected to have a high speed of impulse conduction.

_____

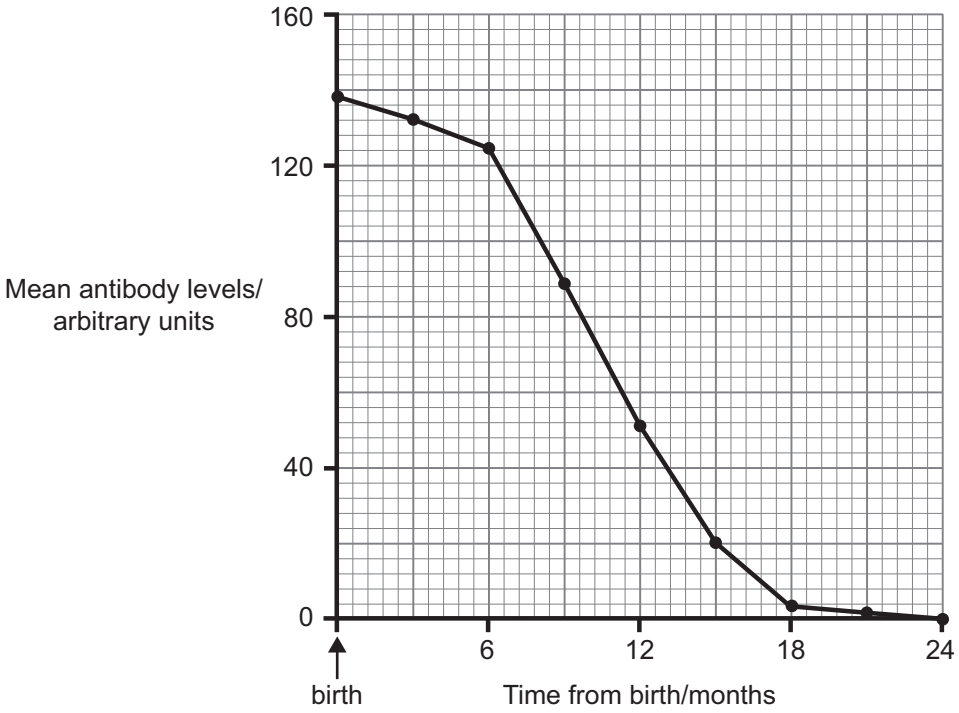
_____

_____

_____ [2]

2 Many people have an immunity to measles as a result of either infection or vaccination. Measles vaccination starts with infants at 15 months.

The measles antibody levels were measured in a group of babies during the first 24 months of life. The results for mean antibody levels are shown in the graph below.



(a) Explain the high levels of the measles antibodies in babies at birth and for the first six months.

_____

_____

_____

_____ [2]

(b) Explain the low levels of the antibody in babies after 12 months.

_____

_____

_____

_____ [2]

(c) Explain why a measles vaccine would not be successful if given within the first six months.

_____

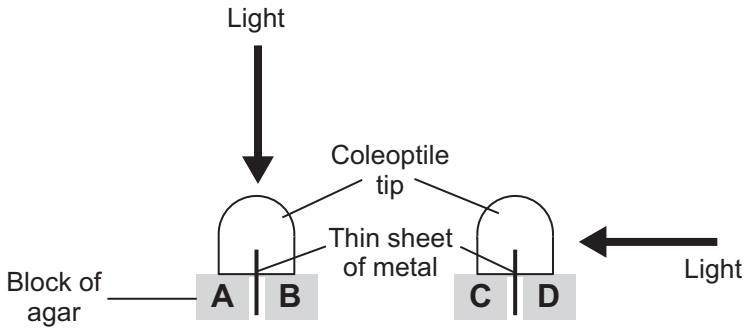
_____

_____ [1]

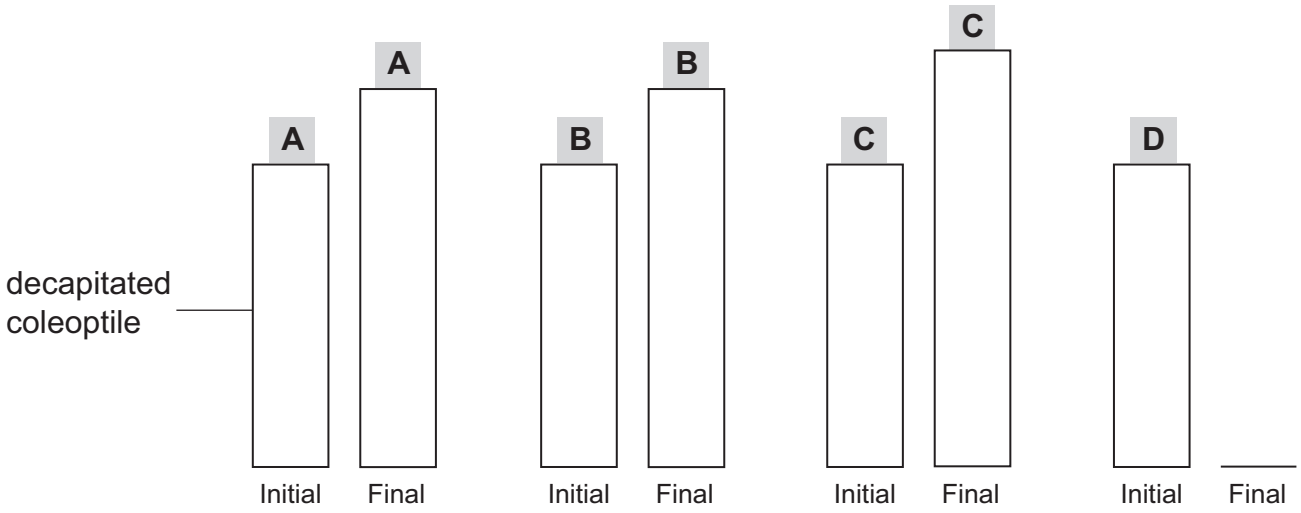
3 An oat seedling has a protective sheath (the coleoptile) which is frequently used as convenient plant material for experiments on phototropism.

An experiment was carried out in which the tips of oat coleoptiles were removed and placed on blocks of agar. The agar blocks underneath each coleoptile were divided by thin sheets of metal. The tips of the coleoptiles were either illuminated evenly from above or from the right during this initial treatment period.

The experiment set-up is shown in the diagram below.



After the treatment outlined above the agar blocks then were placed on decapitated coleoptiles. The diagram below shows the height of the coleoptiles, initially (just after placement of the agar blocks) and finally (after 48 hours).



Examiner Only	
Marks	Remark

(a) Complete the diagram above by drawing a result for agar block **D**. [1]

(b) Explain the changes in height of the four coleoptiles.

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(c) Explain the reason for the inclusion of blocks **A** and **B** in the experiment.

_____

_____

_____ [1]

4 **Photographs 4.4 A, B** and **C** show three mammalian muscle types.

(a) Identify the muscle types in each photograph and state **one** identifying feature for each.

Photograph A

Muscle type _____

Identifying feature _____

_____

Photograph B

Muscle type _____

Identifying feature _____

_____

Photograph C

Muscle type _____

Identifying feature _____

_____ [6]

(b) **(i)** Name the **two** protein filaments present in muscle fibres.

- _____
- _____ [1]

(ii) Describe the arrangement of these protein filaments in the myofibrils of a muscle fibre.

_____

_____

_____

_____ [2]

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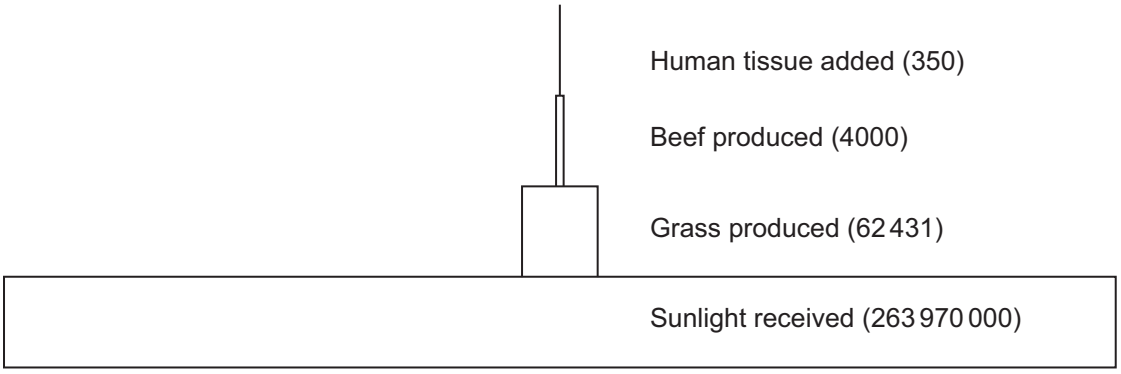
(Questions continue overleaf)

5 The diagram below represents a pyramid of energy (productivity), for a Northern Ireland beef farm. The bars are not drawn to scale though the productivity of each level is indicated (as $kJ\,m^{-2}\,y^{-1}$).



(a) Using the figures above, calculate the percentage efficiency of energy transfer from the sunlight received by the grass to the productivity of the grass. (Show your working.)

_____ [2]

(b) The percentage efficiency of energy transfer from grass to beef is 6.4% while it is 8.75% from beef to human. Account for this difference.

_____

_____

_____

_____ [2]

Modern farming can use a variety of techniques to increase food production for human consumption.

(c) (i) Describe and explain **one** way in which the farmer could increase the yield of grass for his beef cattle to graze.

_____

_____

_____

_____ [2]

(ii) Describe and explain **one** way in which the farmer could increase the yield of beef for human consumption.

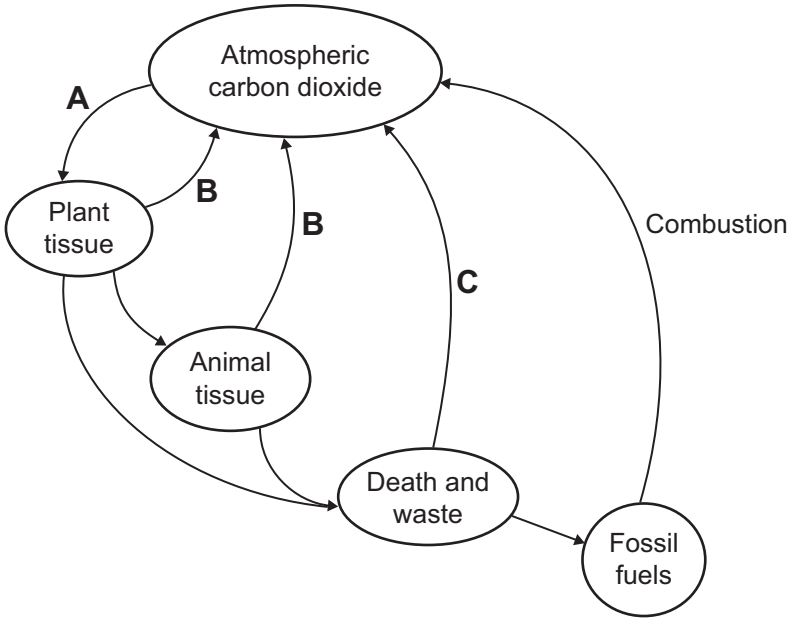
_____

_____

_____

_____ [2]

6 The diagram below represents the carbon cycle.



(a) Identify the processes labelled **A** to **C**.

A _____

B _____

C _____ [3]

(b) The combustion of fossil fuels illustrated in the diagram adds extra carbon dioxide to the atmosphere. Describe the consequences of a build up of carbon dioxide in the atmosphere.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ [5]

(c) (i) Other gases are liberated into the atmosphere during the combustion of fossil fuels. Name **one** of these other gases which can cause acid rain.

_____ [1]

(ii) Describe and explain **one biological** problem caused by acid rain.

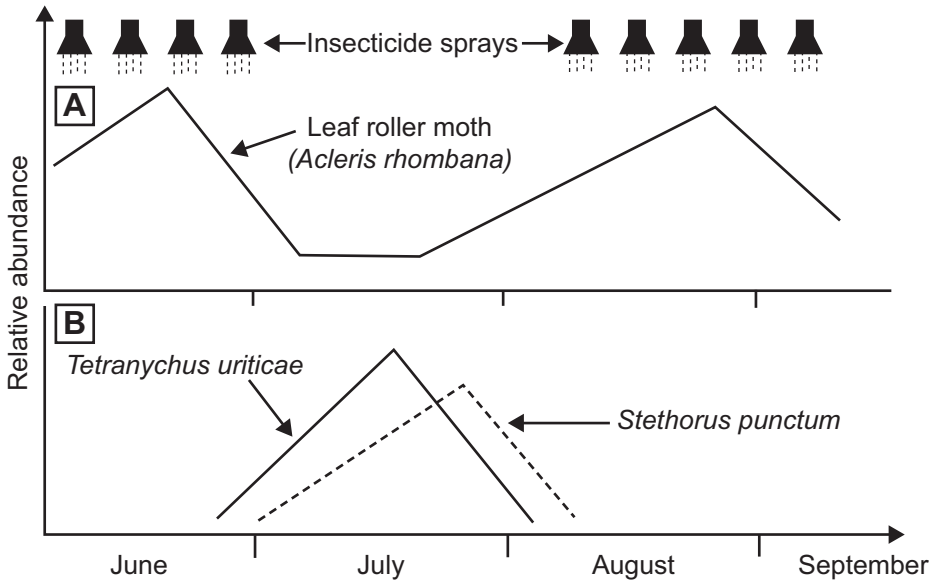
_____

_____

_____

_____ [2]

7 Graph **A** below illustrates how the application of insecticides may protect an orchard by reducing the numbers of the potentially crop-damaging leaf roller moth, *Acleris rhombana*. Graph **B** shows how a break in the application of the insecticide protects other orchard-dwelling animals such as the mites, *Tetranychus uriticae* and *Stethorus punctum*.



(a) An orchard is an example of a "monoculture". Explain why monocultures are particularly susceptible to pest infestations.

_____

_____ [1]

The insecticide used in the orchard is biodegradable.

(b) (i) Identify **one** piece of evidence that suggests this insecticide is biodegradable.

_____

_____ [1]

(ii) Explain why the use of a biodegradable insecticide is safer for the environment.

_____

_____ [1]

Spraying of the insecticide does not take place during the month of July so as not to affect other orchard species such as the mites, *Tetranychus uriticae* and *Stethorus punctum*. One of these species of mite is an important pest of the fruit trees which can cause blemishing of the orchard fruit. The other species is its predator.

(c) Use the information in Graph **B** to help you to determine which mite species is the predator. Explain your answer.

_____

_____

_____ [2]

By not spraying insecticide in July, the population of predatory mites remains high and so reduces blemishing of the orchard fruit by keeping the pest population low.

(d) (i) Name the type of pest control illustrated by this example.

_____

(ii) Suggest **one** advantage of such a pest control system.

_____

_____

(iii) Suggest **one** possible disadvantage of this form of pest control.

_____

_____ [3]

Biologists interested in the efficiency of such a pest control system may need to estimate the population of the leaf roller moths in the orchard using the mark/recapture technique.

(e) (i) Describe how the biologists would carry out the mark/recapture technique to allow them to estimate the size of the population of moths.

_____

_____

_____

_____

_____

_____ [3]

(ii) Suggest **one** assumption which must be fulfilled in order to obtain a valid estimate of the population size.

_____

_____ [1]

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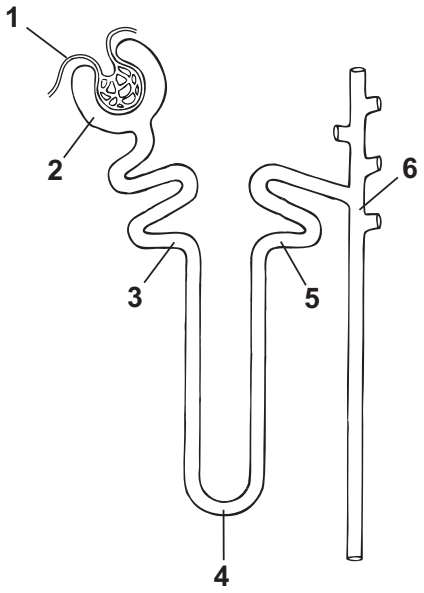
(Questions continue overleaf)

8 In an experiment to investigate the functioning of the mammalian kidney, samples were taken by micropipette from different regions. The diagram below shows the sample sites, labelled 1 to 6.



Each sample was analysed to determine the concentration of glucose, protein, urea and sodium ions. The flow rate was also measured at each of the sample sites. The results are shown in the table below.

Sample sites within the kidney	Concentration/g dm^{-3}				Flow rate /cm^3 min^{-1}
	Protein	Glucose	Sodium ions	Urea	
1. Plasma in afferent arteriole	80	1.2	34	0.3	600.0
2. Filtrate in Bowman's capsule	0.5	1.2	34	0.3	125.0
3. End of proximal convoluted tubule	0	0	34	1.6	25.0
4. Bottom of loop of Henlé	0	0	70	1.8	1.5
5. Beginning of distal convoluted tubule	0	0	30	1.8	1.5
6. Beginning of collecting duct	0	0	45	2.2	1.3

Use the information in this table and your own understanding to answer the following questions.

(a) Explain the changes in the composition of proteins and glucose between the plasma in the afferent arteriole (sample site **1**) and the end of the proximal convoluted tubule (sample site **3**).

- Protein _____

_____

_____

- Glucose _____

_____

_____ [4]

(b) Comment on the changes in sodium ion concentration in the different sample regions.

_____

_____

_____

_____

_____

_____

_____

_____ [4]

(c) Explain the changes in urea concentration as it moves along the nephron.

_____

_____

_____

_____ [2]

(d) Suggest an explanation for the fall in the flow rate as fluid moves from the plasma into and then along the nephron.

_____

_____

_____

_____ [2]

(e) The experiment described on page 18 was carried out at 37 °C. When the experiment was repeated at 30 °C, the glucose concentration at the end of the proximal convoluted tubule was 0.15 g dm^{-3}. Suggest an explanation for this result.

_____

_____

_____

_____

_____

_____ [3]

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(Questions continue overleaf)

Section B

9 *Quality of written communication is awarded a maximum of two marks in this section.* [2]

Give an account of the functioning of the mammalian eye to include the role of the following:

- the iris
- the lens
- rods
- cones [16]

THIS IS THE END OF THE QUESTION PAPER

Photographs 4.4 A, B and C
(for use with Question 4)