

Answer Questions 1 and 2 in the spaces provided.

1. (a) Explain what is meant by each of the following terms.

Action potential

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(2)

Transmitter substance

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(2)

- (b) The table below shows the relationship between the diameter of a number of myelinated axons and the conduction velocity (speed of conduction of the nerve impulse).

Diameter of axon / μm	Conduction velocity / m sec^{-1}
2	15
4	21
6	38
8	45
10	60
12	75
14	82



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Describe the relationship between axon diameter and the conduction velocity.

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(2)

- (c) Ouabain is a substance which is present in the seeds of certain plants. Ouabain has been shown to be an inhibitor of the ATPase enzyme associated with the sodium-potassium pump in the cell surface membrane.

Suggest what effect ouabain would have on the conduction of nerve impulses. Give an explanation for your answer.

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(3)

Q1

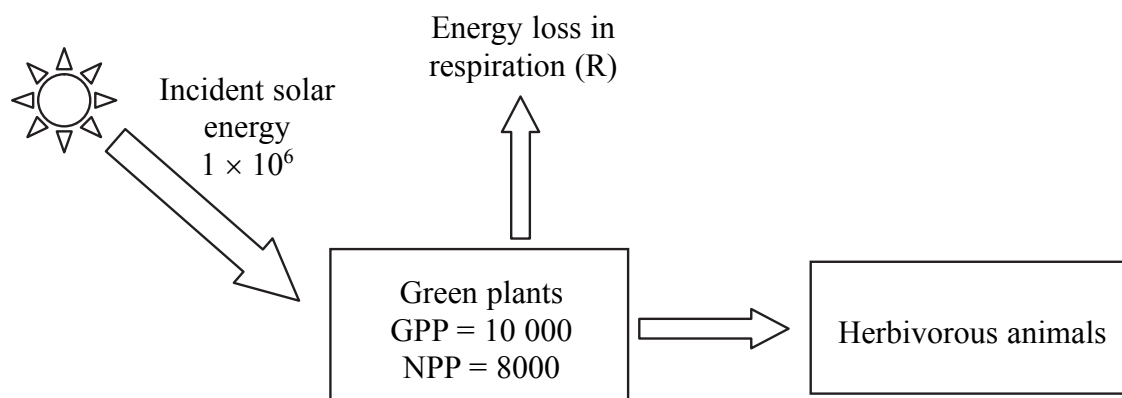
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2. (a) The diagram below shows energy flow in part of a terrestrial ecosystem. All figures are in $\text{kJ m}^{-2} \text{yr}^{-1}$.



(i) Explain why not all the incident light energy falling on a green plant is used by the plant for gross primary production (GPP).

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(3)

(ii) Calculate the energy loss in respiration (R) by green plants.

Answer

(1)

(iii) Calculate the percentage of the incident solar energy that becomes incorporated into the net primary production (NPP). Show your working.

Answer%

(2)



(b) Locusts are herbivorous insects that can cause enormous losses to growing crops. Adult female locusts lay eggs which hatch into 'hoppers'.



A locust hopper
Magnification $\times 3$

An investigation was carried out to study the effects of feeding either maltose or glucose on the growth of locust hoppers. Groups of hoppers were fed on a diet containing equivalent concentrations of the two carbohydrates.

The results are shown in the table below.

Days after hatching	Mean mass of hoppers / mg	
	Diet containing maltose	Diet containing glucose
0	25	25
6	70	65
12	250	240
18	560	450

(i) Compare the growth of hoppers when fed on these two carbohydrates.

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(ii) Suggest why locusts require carbohydrates in their diet.

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(2)

(c) Biopesticides are a type of biological control mechanism. It is possible to control locusts using a biopesticide made from a naturally-occurring fungus (*Metarhizium* sp.) which infects locusts. This fungus can be mixed with a liquid and sprayed onto large areas. Once infected with the fungus, locusts die within four to ten days.

Suggest advantages of using biopesticides, rather than chemical insecticides, for the control of locusts.

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(4)

Q2

(Total 14 marks)



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Write an essay on ONE of the following topics.

For Biology you should choose EITHER Question 3 OR Question 4B.

3. Nucleic acids and the effects of point mutations. (15 marks)

4B. The transport and roles of water in flowering plants. (15 marks)

For Biology (Human) you should choose EITHER Question 3 OR Question 5H.

3. Nucleic acids and the effects of point mutations. (15 marks)

5H. The growth of human populations and the causes and effects of desertification. (15 marks)

Marks will be awarded for scientific content, coverage of the topic, and the quality of written communication. You should include in your answer any relevant information from the whole of your course. You may include diagrams if you wish, but make sure that they are relevant to your essay and add extra information to it.

Indicate which question you have chosen by marking the box (☒). If you change your mind, put a line through the box (☒) and then indicate your new question with a cross (☒).

Chosen question number: Question 3 ☒

Question 4B ☒

Question 5H ☒

Write your answer, including any plan, here.

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TOTAL FOR PAPER: 38 MARKS

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