INTERNATIONAL BACCALAURÉAT BACHILLERATO
BACCALAUREATE INTERNATIONAL INTERNACIONAL

N99/410/S(3)

BIOLOGY

Standard Level

Thursday 11 November 1999 (morning)

Paper 3 — 1 hour 15 minutes

A

Candidate name:	Candidate category & number:

This examination paper consists of 7 Options.
The maximum mark for this paper is 45.

INSTRUCTIONS TO CANDIDATES

Write your candidate name and number in the boxes above.

Do NOT open this examination paper until instructed to do so.

Answer ALL of the questions from THREE of the Options in the spaces provided.

At the end of the examination, complete box B below with the letters of the Options answered.

B

OPTIONS ANSWERED	
Number of extra sheets attached	

C

EXAMINER	TEAM LEADER
/15	/15
/15	/15
/15	/15
TOTAL /45	TOTAL /45

D

IBCA
/15
/15
/15
TOTAL /45

EXAMINATION MATERIALS

Required:
Calculator

Allowed:
A simple translating dictionary for candidates not working in their own language

Option A — Diet and Human Nutrition

A1. A common form of malnutrition is a diet lacking in energy or protein or both. The column below shows the results of a study into the effects of such malnutrition on very young children.

Group	When malnutrition started	Birth mass / kg	Total DNA content of children's brains at age 2 years / mg	Mean total DNA content of children's brains at age 2 years / mg
I	before birth	Less than 2	361	347
			315	
			378	
			333	
II	at birth	2.5	685	725
			711	
			720	
			738	
			774	
			720	
III	at about 18 months	2.5	846	870
			900	
			864	
IV	no malnutrition	2.5	920	
			893	
			881	
			910	

[Source: M Winick, *Early nutrition and brain development* (1978), Carolina Biology Readers No 93]

(a) Calculate the mean total DNA content of the brain for the children in Group IV. *[1]*

Answer .....

(b) State the reason for the low birth mass of the children in Group I. *[1]*

.....

(c) Using only the data in the table, evaluate the effects of malnutrition on brain development. *[3]*

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(This question continues on the following page)

(Question A1 continued)

(d) In each group the total brain DNA content of the children is variable. Suggest **two** reasons for the variation within the groups. *[2]*

1 .....

.....

2 .....

.....

A2. (a) State **two** functions of calcium in the body. *[2]*

1 .....

.....

2 .....

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(b) Compare the way vegans and lacto-vegetarians obtain calcium. *[2]*

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A3. (a) Outline the importance of hygienic methods of food handling and preparation. *[2]*

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(b) Some food contains preservatives.

(i) State how a consumer could find out if a food contains a preservative. *[1]*

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(ii) State **one** reason for a consumer objecting to the addition of preservative in food. *[1]*

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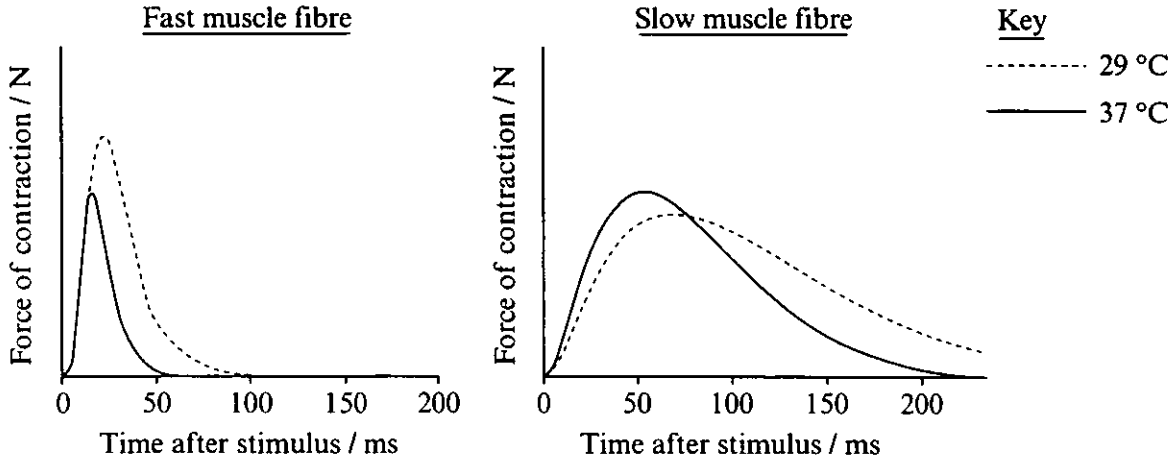
Option B — Physiology of Exercise

B1. The graphs below show the force of contraction produced by fast and slow skeletal muscle fibres. Both muscle fibres were stimulated to contract at two temperatures, 29°C and 37°C.



[Source: A J Buller (1975), Oxford Biology Reader No 36]

(a) Measure the time taken after the stimulus to reach maximum contraction for the fast muscle fibres at 37 °C. *[1]*

Answer: .....

(b) Using only the data in the graphs, compare the activity of the two types of fibre by completing the table below to show **three** differences. *[3]*

	Fast muscle fibre	**Slow muscle fibre**
1.	....	....
2.	....	....
3.	....	....

(This question continues on the following page)

(Question B1 continued)

(c) (i) Explain, using the data in the graphs, whether fast or slow muscle fibres have the greater need for a warm-up routine. *[2]*

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(ii) Outline the injuries that can result from exercise without a warm-up routine. *[2]*

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B2. (a) State the type of respiration that causes an oxygen debt in the body. *[1]*

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(b) Explain how the oxygen debt is repaid. *[3]*

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B3. (a) Evaluate **stamina** as a measure of fitness. *[2]*

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(b) State **one** other measure of fitness. *[1]*

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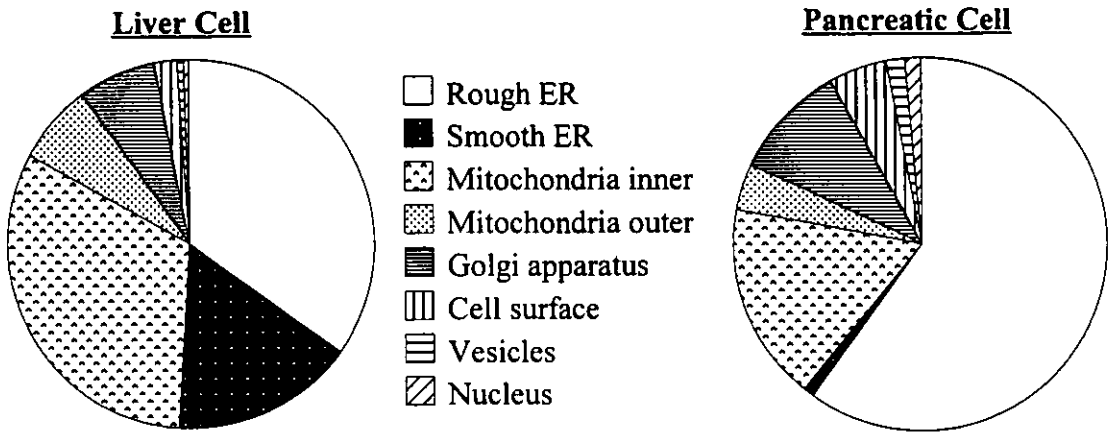
Option C — Cells and Energies

C1. The pie charts show the relative amounts of types of membrane found in two types of cell.



[Source: B. Alberts *et al, The Cell* (1989)]

(a) State which type of membrane is present in the greatest amount in the liver cell. *[1]*

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(b) (i) Compare the relative amounts of mitochondrial membranes in the two types of cell. *[2]*

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.....

(ii) Suggest **one** reason for the difference between the cells types in amount of mitochondrial membranes. *[1]*

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(c) Using only the data in the pie charts, predict which cell type secretes more protein. Give **two** reasons for your answer. *[2]*

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(d) Predict which type of membrane would be present in the largest relative amount in a prokaryote cell. *[1]*

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C2. Describe the *induced fit* model of enzyme action. *[3]*

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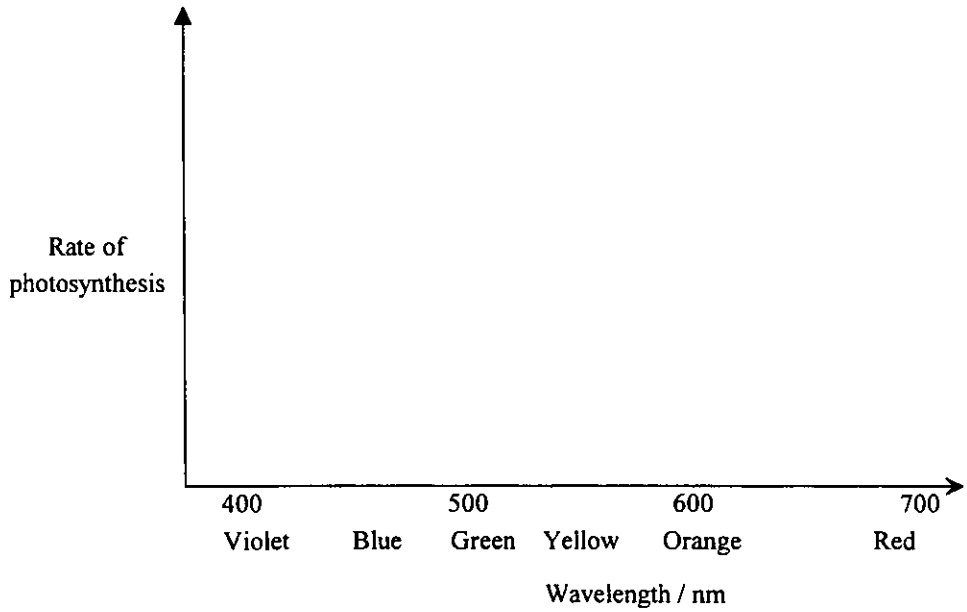
C3. (a) Draw a curve of the action spectrum for photosynthesis on the axis below. *[2]*



(b) Explain the relationship between the action spectrum and the absorption spectra of photosynthetic pigments. *[3]*

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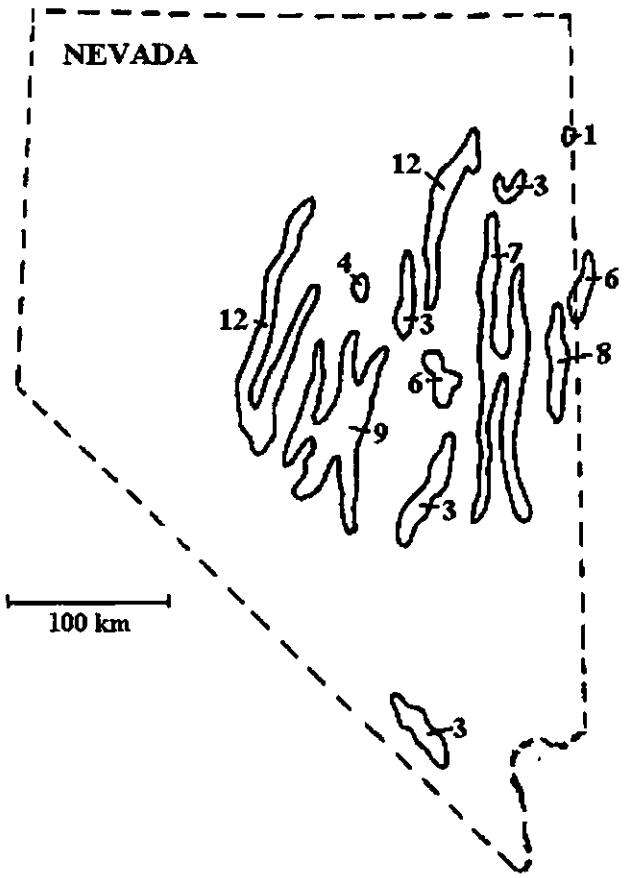
Option D — Evolution

D1. The map below shows mountains that rise above 3000 metres in the Great Basin desert of Nevada. The number of species of small flightless mammals found on each mountain is indicated.



[Source: Scientific American, May (1978), 239, No 3, page 118]

(a) (i) State the maximum and the minimum number of species found on the mountains. *[1]*

Maximum ..... Minimum .....

(ii) State the relationship between the area of the mountains and the number of species found on them. *[1]*

.....

.....

(iii) Suggest **one** reason for the differences in the numbers of species on the mountains. *[1]*

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.....

(This question continues on the following page)

(Question D1 continued)

These mammals are not found today in the areas between the mountains but it has been suggested that two million years ago they were found all over the basin.

(b) Suggest **one** type of evidence which would show that these mammals occupied the whole basin two million years ago. *[1]*

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(c) Explain what might happen during the next two million years to a species found on two widely separated mountains. *[3]*

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D2. (a) Outline a theory which explains the origin of eukaryotic cells. *[2]*

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(b) State **two** pieces of evidence which support this theory. *[2]*

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D3. (a) Outline the ecological changes associated with the evolution of the genus *Homo* in east Africa three million years ago. *[2]*

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(b) Explain the difficulties of using only fossil evidence to establish evolution of the genus *Homo*. *[2]*

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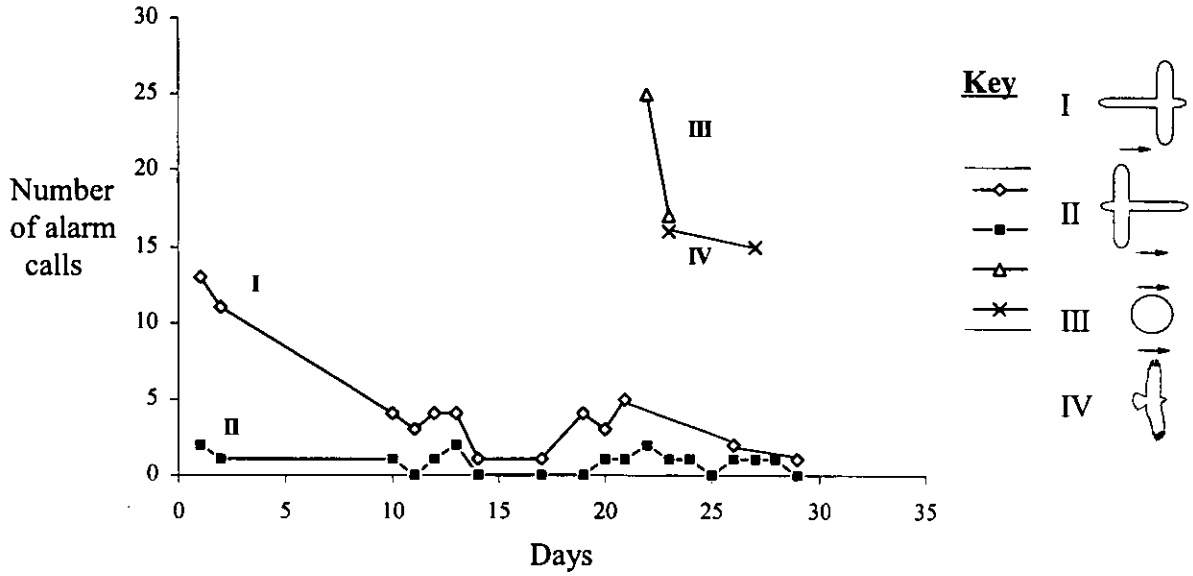
Option E — Neurobiology and Behaviour

E1. Many birds make alarm calls when they are frightened. Biologists investigated this behaviour in turkeys by passing models of predators along on a wire over the cage where the turkeys were kept. Four models were passed over the same group of birds during a four week period. The number of alarm calls were counted. The results are shown in the graph below.



[Source: Slater 1974 IOB Synopsisium No 2]

(a) (i) Outline how the turkeys responded to model I during the first fourteen days. *[1]*

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(ii) Explain these responses shown by the turkeys to model I during the first fourteen days. *[2]*

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(b) Suggest a reason for the different responses of the turkeys to model II compared with model I. *[1]*

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(This question continues on the following page)

(Question E1 continued)

Models III and IV were each only used twice, near the end of the experiment period.

(c) (i) Using only the data in the graph, compare the responses of the turkeys to models III and IV. *[2]*

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(ii) Suggest a reason for the differences in the response. *[1]*

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. . . . . .

(iii) Alarm calls might attract the attention of predators. Explain the selective advantage of alarm calls. *[2]*

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E2. (a) State which type of receptor is found in the eye. *[1]*

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(b) Outline the neural pathway involved in the pupil reflex. *[2]*

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(c) State how this reflex can be used to find out the condition of the central nervous system. *[1]*

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E3. Explain **one** example of how a taxis improves the chances of survival of an animal. *[2]*

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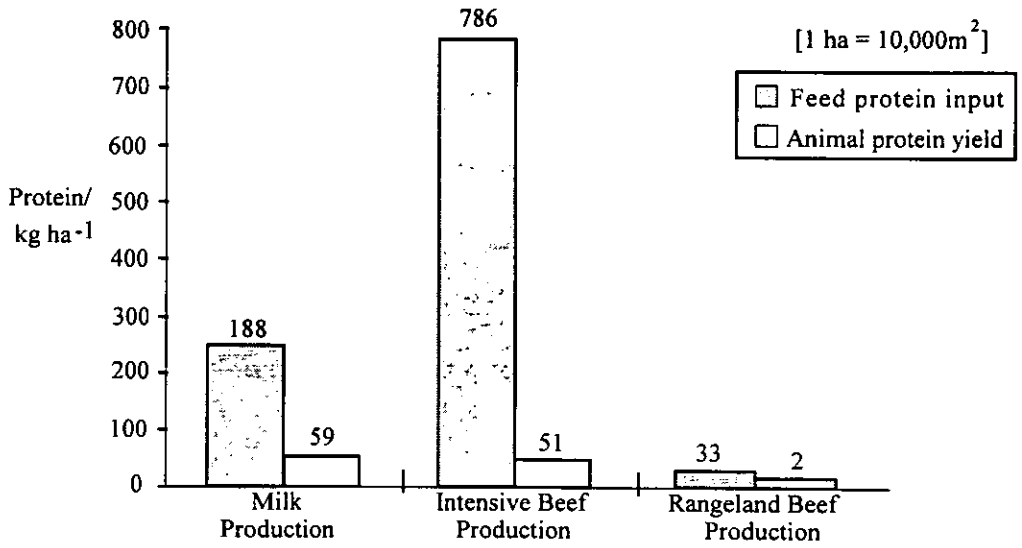
Option F — Applied plant and animal science

F1. The bar chart below shows the feed protein input and the protein yield for three production systems. In milk and intensive beef production systems, large amounts of cereals are fed to cattle. Beef cattle raised on rangeland feed mainly on fibrous plants such as grass and are free to wander over large areas.



[Source: D & M Pimentel, *Food, Energy and Society*, (1979), Edward Arnold]

(a) State which system produces the highest yield of protein per hectare (ha). *[1]*

. . . . . .

(b) (i) Compare the efficiency of conversion of feed protein into protein in milk or beef in these three production systems. *[2]*

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. . . . . .

(ii) Suggest a reason for the differences in efficiency. *[1]*

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(c) Suggest **two** advantages of the rangeland beef system compared with the two other systems. *[2]*

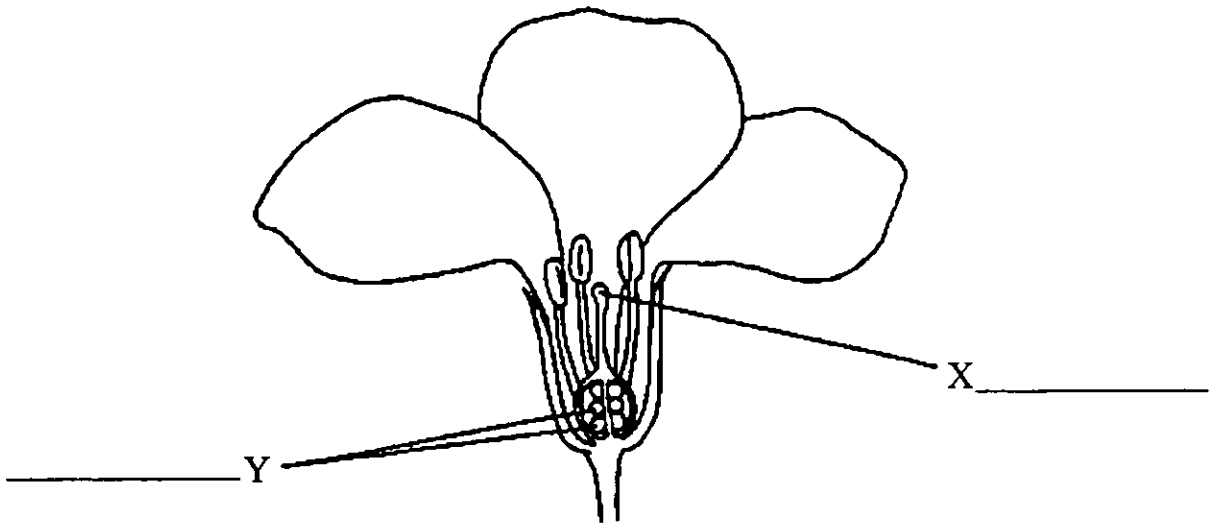
1 . . . . . .

. . . . . .

2 . . . . . .

. . . . . .

F2. (a) State the names of the structures labelled X and Y on the diagram. *[2]*



(b) Explain how plant breeders can make sure that a flower is pollinated with pollen from another plant. *[2]*

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F3. (a) Outline the effects of leaf-eating insect pests on cereal crops. *[2]*

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(b) Evaluate monoculture as a method of increasing crop production. *[3]*

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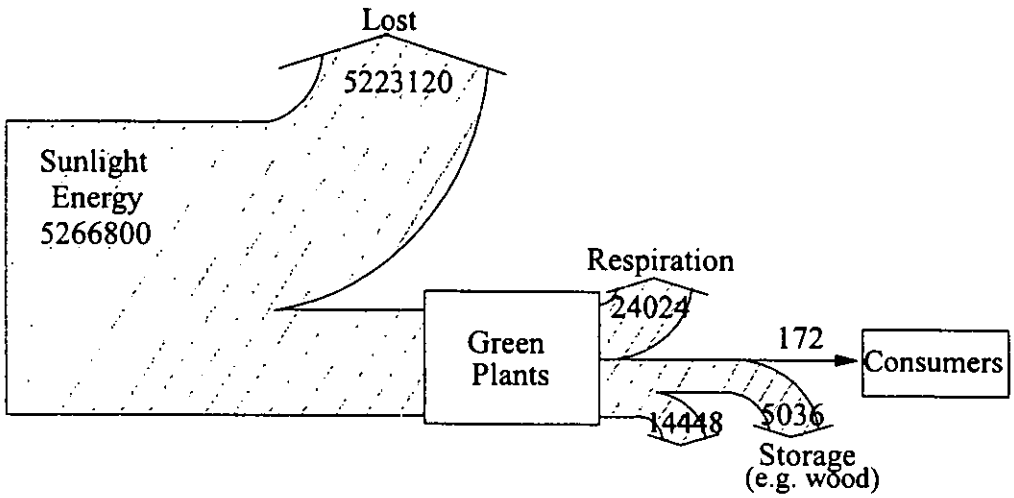
Option G — Ecology and Conservation

G1. The chart below shows the energy flow though a temperate forest. The energy flow is shown per square metre per year (kJ m^{-2} $year^{-1}$).



[Source: J R Grosz *et al*, Scientific American (1978), 238, No 3, page 92]

(a) (i) Calculate the net production of the plants from the data given. *[2]*

Answer: .....

(ii) Calculate the gross production of the plants from the data given. *[1]*

Answer: .....

(b) The chart shows that 99.17% of the sunlight energy in the temperate forest is lost. Predict with reasons whether a greater or lesser percentage of sunlight energy would be lost in a desert. *[2]*

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(c) Only a small part of the net production of plants in the temperate forest passes to herbivores. Explain the reasons for this. *[2]*

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G2. The soil contains many chemical substances dissolved in water, including mineral nutrients.

(a) State **one** example of a mineral nutrient. *[1]*

. . . . . .

(b) Outline **two** other soil factors which can affect the distribution of plants. *[2]*

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G3. (a) Outline **one** factor that has caused the extinction of a named animal species. *[2]*

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(b) Discuss the role of international organisations in conservation using the World Wide Fund for Nature (WWF) as an example. *[3]*

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