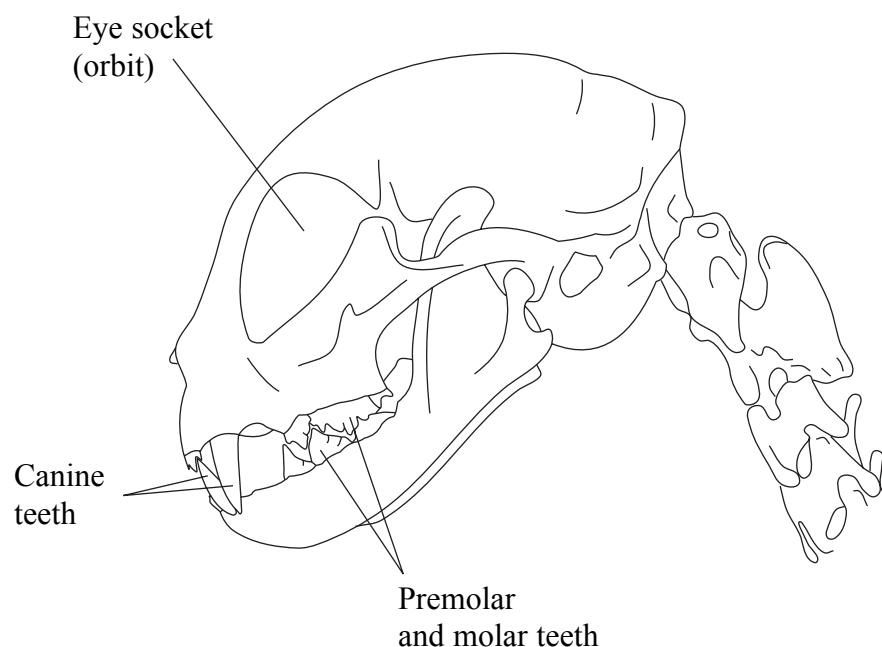


Answer ALL questions in the spaces provided.

1. The diagram below shows the skull of a mammal.



(a) State the term that is used to describe the form of feeding shown by this mammal, in which organic material is obtained from the bodies of other organisms.

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(1)

(b) Suggest what type of organic material probably formed the main part of the diet of the mammal shown in the diagram.

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(1)



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(c) For each of the labelled features, explain how the position, shape or structure supports your answer to part (b).

Eye socket

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Canine teeth

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Premolar and molar teeth

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(6)

Q1

(Total 8 marks)



2. After a crop has been harvested, the remains of the plants, known as residues, may be dug into the soil to allow them to decompose. This process is called green manuring.

It has been shown that in as little as 10 weeks, in well-aerated soil, 70% of the organic nitrogen compounds in the residues are converted into nitrates. It has been estimated that 0.3% of the fresh biomass in a residue will be available as nitrate for the next crop.

The table below shows the estimated potential yield of nitrate from the residues of different crops.

Crop	Fresh biomass of residue used for green manure /kg per hectare	Estimated potential yield of nitrate/kg per hectare
Brussels sprout	60 000	
Cauliflower	40 000	120
Carrot	30 000	90
Leek	20 000	60
Radish	10 000	30

[Data adapted from Tremblay, N., Scharpf, H., Weier, U., Laurence, H. & Owen, J., *Nitrogen Management in Field Vegetables – Agriculture & Agri-Food Canada*]

- (a) Explain what is meant by the term **biomass**.

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 (1)

- (b) Calculate the potential yield of nitrate for the Brussels sprout crop. Show your working.

Answer
 (2)



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(c) The initial products of decomposition of the organic compounds in the residues are ammonium compounds.

Name and describe the process by which ammonium compounds are converted into nitrates in well-aerated soil.

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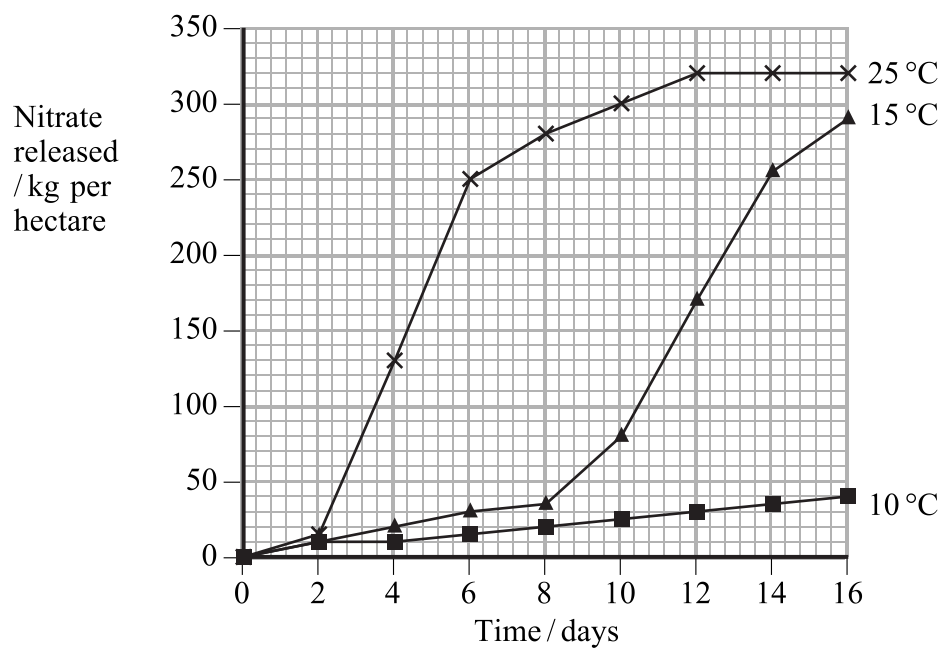
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(4)



(d) In a study of the rate of decomposition of cauliflower residues the effect of soil temperatures of 10, 15 and 25 °C on the rate of nitrate release was estimated.

The graph below shows the results of this study.



[Data adapted from Tremblay, N., Scharpf, H., Weier, U., Laurence, H. & Owen, J., *Nitrogen Management in Field Vegetables* – Agriculture & Agri-Food Canada]

(i) Compare the rate of nitrate release from cauliflower residues at 10 °C with that at 15 °C.

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(3)



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(ii) Using the information in the graph, suggest why 15°C is the best soil temperature for sowing a crop after green manuring.

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(2)

(Total 12 marks)

Q2

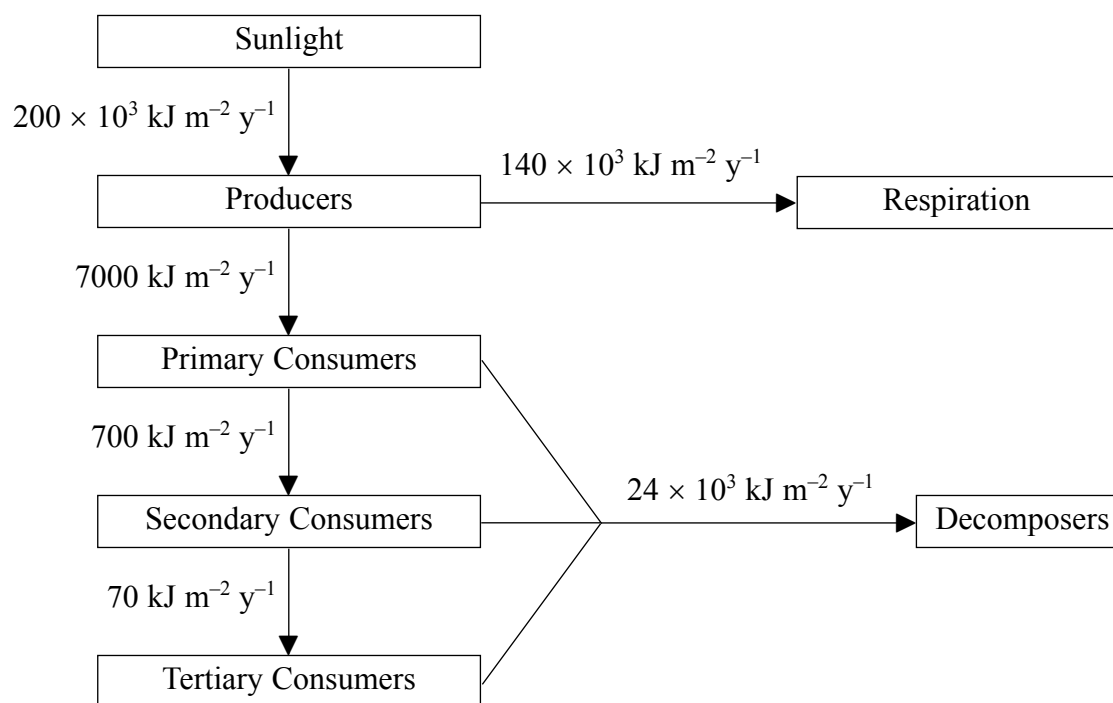
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3. A group of students carried out an investigation to determine the energy flow in a rainforest food chain. They collected invertebrate animals from trees, identified them and placed them in the appropriate trophic level.

For each trophic level the animals were counted, weighed and the energy content determined. Using their data and other sources of information the students produced a diagram to show the energy flow along the food chain. The diagram is shown in Figure 1.

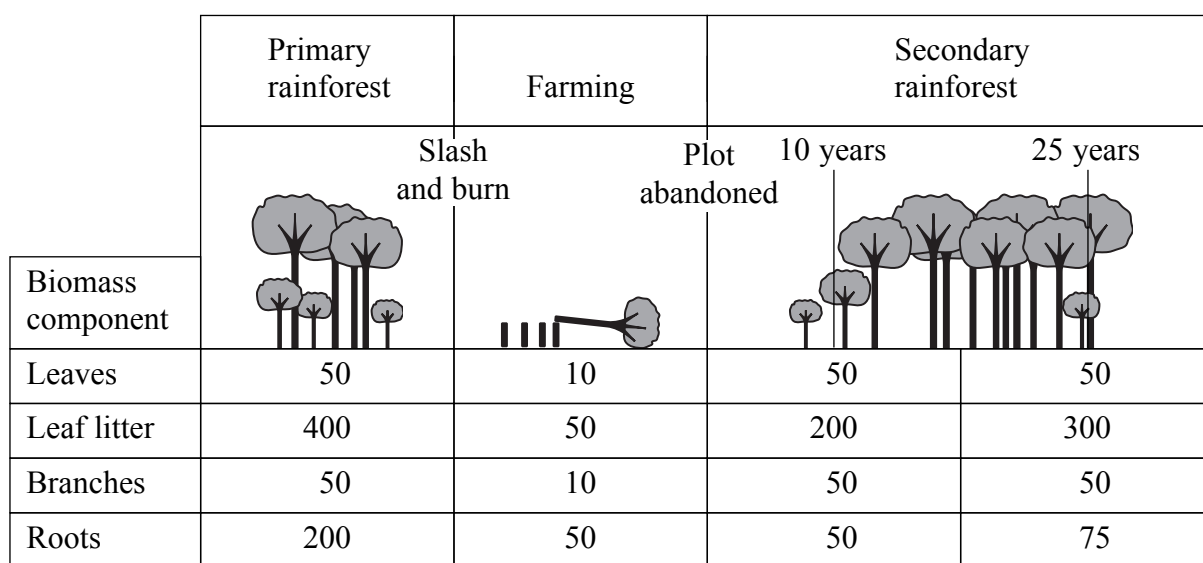
Figure 1



Some farmers clear plots of rainforest to use for crops. The trees are felled and then burnt. This practice is called slash and burn. The soil is left covered in ash, which is rich in nutrients. However, the nutrients are soon used up by the growing crops. Within two or three years the plot is abandoned and the farmer moves on to a new plot.

The abandoned plot is colonised by tree species and eventually the land is covered by secondary rainforest. The sequence of events is shown in Figure 2. This figure also shows that the total biomass of the rainforest trees is made up of leaves, stems and branches, roots and leaf litter. These components of the biomass change as the rainforest is cleared, farmed and then abandoned.

Figure 2



The biomass components are shown in million tonnes per hectare.



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(a) Define the term **net primary production (NPP)**.

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(2)

(b) (i) Explain why only a small percentage of the light energy falling onto a leaf is converted into chemical energy.

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(2)

(ii) Explain why only 10% of the energy locked up in the secondary consumers is transferred to the tertiary consumers.

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(3)



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(c) The energy shown entering the decomposers in Figure 1, is much greater than that entering all of the consumers. Suggest an explanation for this difference.

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(1)

(d) (i) Using Figure 2, compare the components of the biomass of the primary rainforest with those of the secondary rainforest after 25 years.

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(ii) Using all of the information provided, suggest why slash and burn farming is considered to be unsustainable.

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(e) Suggest how the biodiversity of the surrounding rainforest could be changed by the practice of slash and burn. Give reasons for your answer.

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(4)

Q3

(Total 18 marks)

TOTAL FOR PAPER: 38 MARKS

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