Centre No.						Paper Reference							Surname	Initial(s)
Candidate No.						6	1	0	3	/	0	3	Signature	

Paper Reference(s)

6103/03

Edexcel GCE

Biology

Biology (Human)

Advanced Subsidiary

Unit 3 Paper 03

Wednesday 9 January 2008 – Morning

Time: 1 hour

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
Total	

Materials required for examination
Ruler

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number, candidate number, your surname, initial(s) and signature.
The paper reference is shown above. Check that you have the correct question paper.
Answer ALL questions. Write your answers in the spaces provided in this question paper.
Show all the steps in any calculations and state the units. Calculators may be used.
Include diagrams in your answers where these are helpful.

Information for Candidates

The marks for individual questions and parts of questions are shown in round brackets: e.g. **(2)**.
There are 3 questions in this question paper. The total mark for this question paper is 38.

Advice to Candidates

You will be assessed on your ability to organise and present information, ideas, descriptions and arguments clearly and logically, taking account of your use of grammar, punctuation and spelling.

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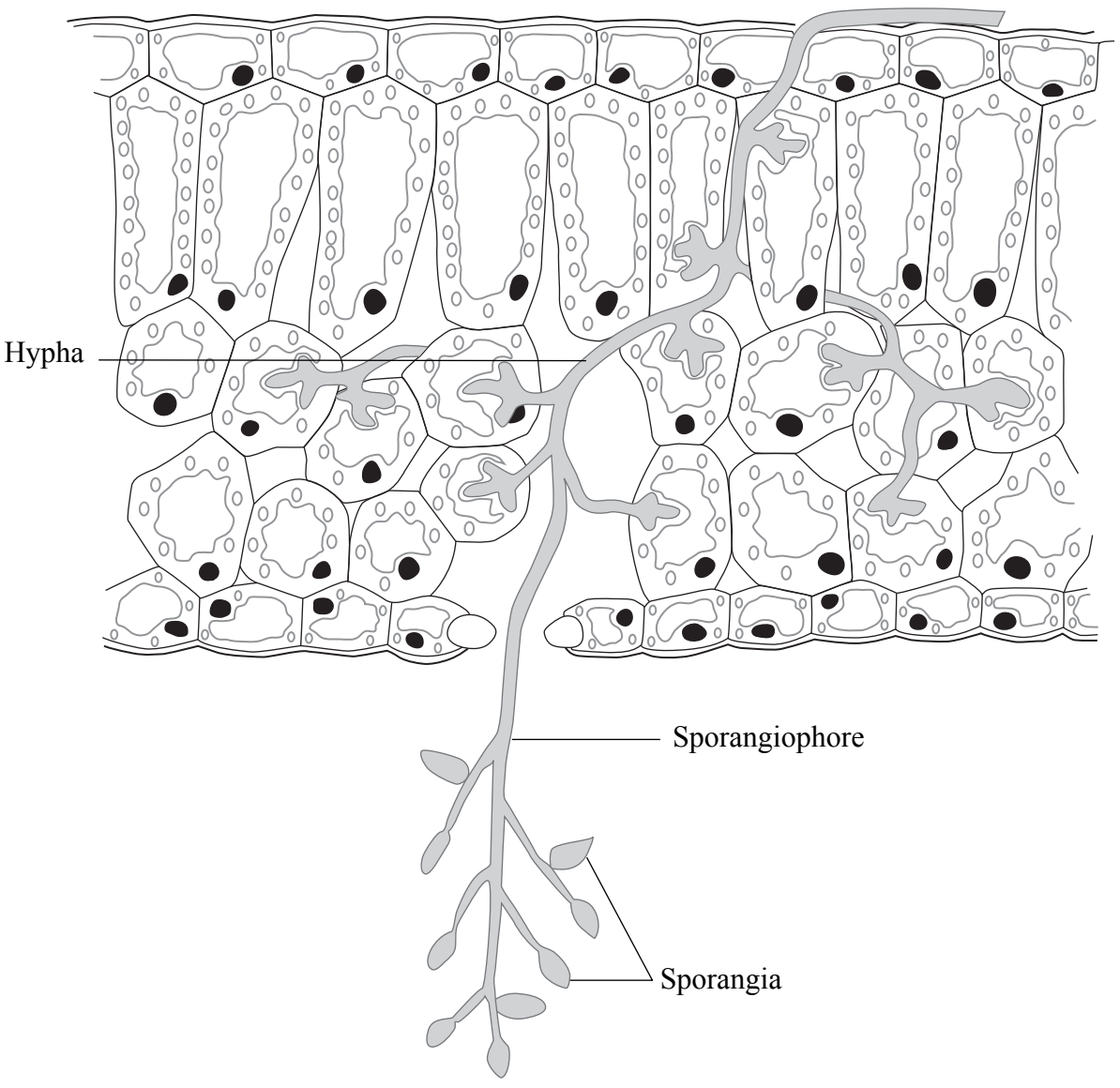
Answer ALL questions in the spaces provided.

1. Potatoes are a major crop in many parts of the world. The starch stored in potatoes is produced from the glucose made by photosynthesis in the leaves of these plants. Potato plants can be infected with a parasitic fungus called *Phytophthora infestans*. Infection by this fungus leads to the disease known as Potato Blight.

The hyphae of the fungus, which grow between the leaf cells of the potato plant, secrete cellulase that breaks down the cell walls of the leaf cells. The contents of the leaf cells are then digested by other hydrolytic enzymes secreted as the hyphae penetrate into the cells. The products of digestion are then absorbed into the hyphae.

The diagram below shows a section through a potato leaf infected with *Phytophthora infestans*.



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(a) (i) Describe two ways in which the nutrition of the fungus *Rhizopus* sp., is similar to that of the fungus *Phytophthora infestans*.

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(ii) Describe two ways in which the nutrition of the fungus *Rhizopus* sp., differs from that of the fungus *Phytophthora infestans*.

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(b) Suggest why potato plants infected by *Phytophthora infestans* are unable to grow and produce potatoes.

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(2)

Q1

(Total 6 marks)

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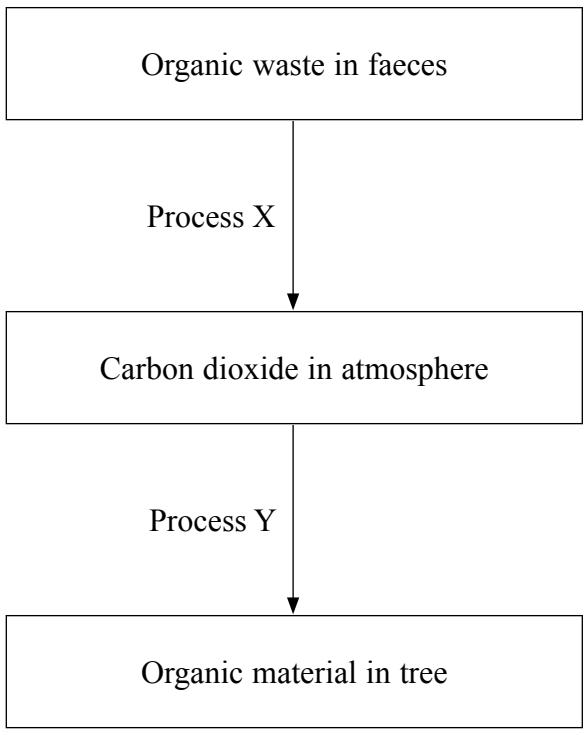
2. The carbon cycle involves many different organisms and processes. Figure 1 shows how carbon atoms in the organic waste in the faeces of a mammal may eventually be incorporated into the organic material forming the wood of a tree.

Figure 1



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The formation of woody biomass in large forests acts as an important carbon sink. A study of northern hemisphere forests made estimates of the carbon stored in woody biomass (carbon pool) and the mean rate of carbon uptake, in the late 20th century. These estimates are shown below in Figure 2.

Figure 2

[t = tonnes, ha = hectare, yr = year]

Country	**Average carbon pool / t ha^{-1}**	**Area of forest / ha × 10^6**	**Total carbon pool in forest / t × 10^6**	**Mean rate of carbon uptake / t yr^{-1} × 10^6**
Canada	44.09	239.5	10 560	73.12
USA	57.91	215.5	12 480	141.53
China	25.77	142.6	3 675	38.62
Finland	34.88	17.2	600	5.56
Japan	47.35	19.0	900	11.92
Russia	37.98		24 391	283.59
Sweden	39.86	26.5	1 056	13.86
Others	59.40	117.4	6 974	116.17

(a) With reference to a suitable type of organism, explain how the carbon in the organic waste in faeces may be converted to carbon dioxide in the atmosphere by process X in Figure 1.

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(b) (i) Name process Y, shown in Figure 1.

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(ii) Explain why only a proportion of the organic material, formed using carbon dioxide, will become plant tissues.

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(c) Explain the meaning of the term **carbon sink**.

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(d) Using the data in Figure 2, calculate the estimated area of forest in Russia. Show your working.

Answer .....

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(e) The data for the areas of forest and the carbon pools in Canada and the USA are fairly similar and yet the mean rate of carbon uptake per year in Canada is approximately half that in the USA. Suggest **two** reasons for this considerable difference in the mean rates of carbon uptake in the forests of these two countries.

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(f) Explain how deforestation could have an effect upon the mean temperature of the Earth's surface.

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Q2

(Total 15 marks)

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3. A river is an ecosystem which is influenced by the biotic and abiotic factors that are present within the river itself. The water in a river drains into it from its catchment area. Factors within the catchment area also have an effect on the river's ecosystem.

In a river, there are two sources of plant material that contribute towards the net primary production. The first source is the living plants which grow within the river itself. Most of these are algae forming a surface covering on rocks near the surface or suspended in the upper layers of water. The second source is dead plant material, such as leaves, that is brought in from the surrounding land. This forms most of the layer of decomposing organic material (detritus) found on the bed of the river.

The relative quantities of these two types of plant material can determine the types of consumers in the dependent food chains. The grazing invertebrates that feed on algae tend to form the main food source for trout and other carnivorous river fish. Invertebrates that feed in the detritus layers are not easily seen and do not form a major part of the diet of most of these fish.

In New Zealand, the Wangapeka River and the Motupiko River meet to form the Motueka River which flows into the sea. A study of the Motueka River was carried out to estimate the influence of dead plant material from the catchment area on the ecosystem. Nine sampling sites between the sources of the rivers and the sea were selected. The three rivers and the sampling sites in the catchment area of the study are shown in Figure 1.

At each of the sampling sites, gross primary production (GPP) of algae was estimated by measuring the production of oxygen in the water over a 24 hour period. As oxygen is released, a proportion of it will be used during respiration of all organisms in the river community. This uptake of oxygen, which was also estimated, is known as community respiration (CR). The estimates were made during winter and summer. These results are shown in Figure 2 and Figure 3.

[Data adapted from Cawthron Research News September 2002]

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Figure 1 – The Wangapeka, Motupiko and Motueka river system.

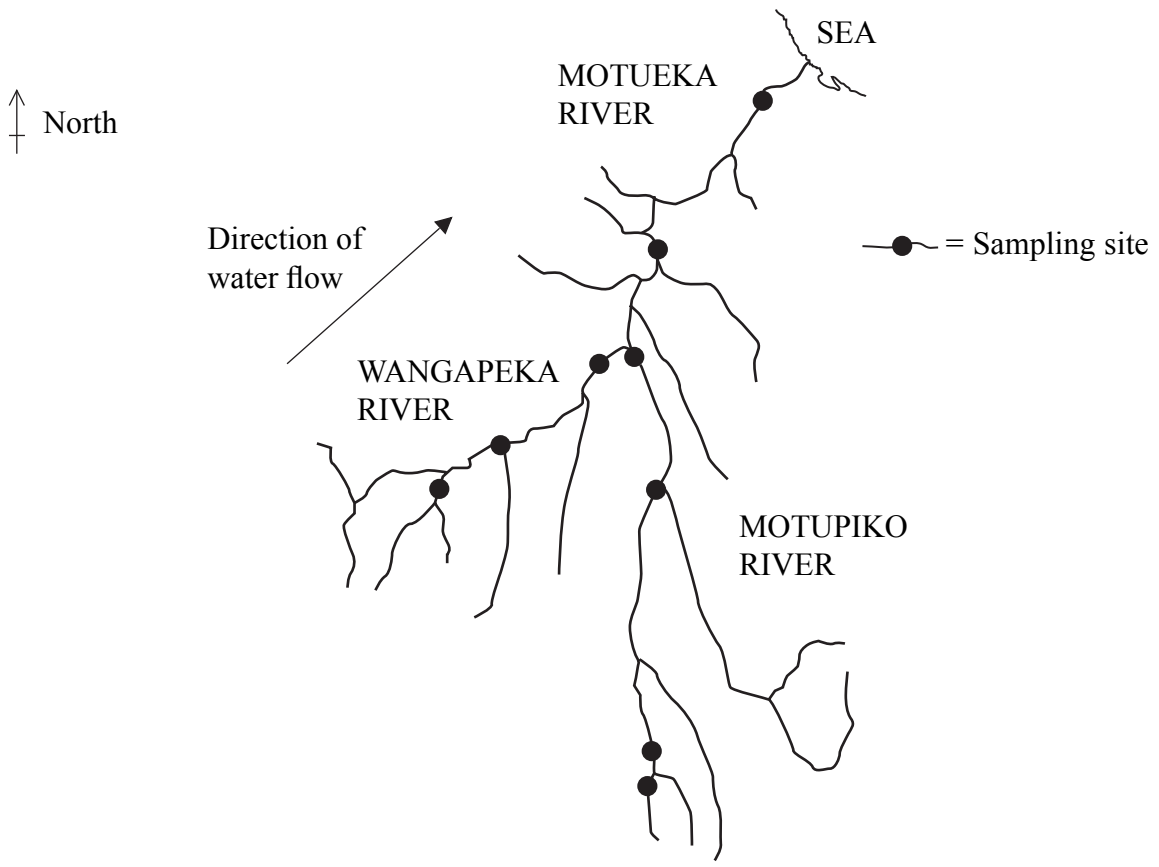

Figure 2 – Gross primary production in the Motueka River catchment area.

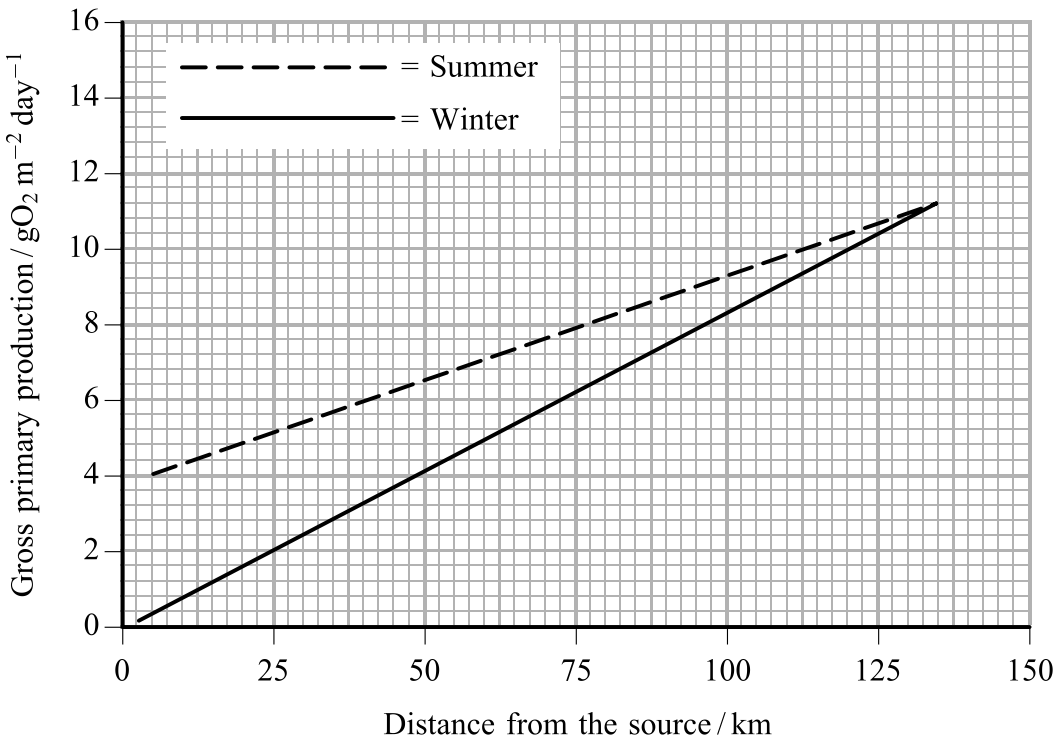

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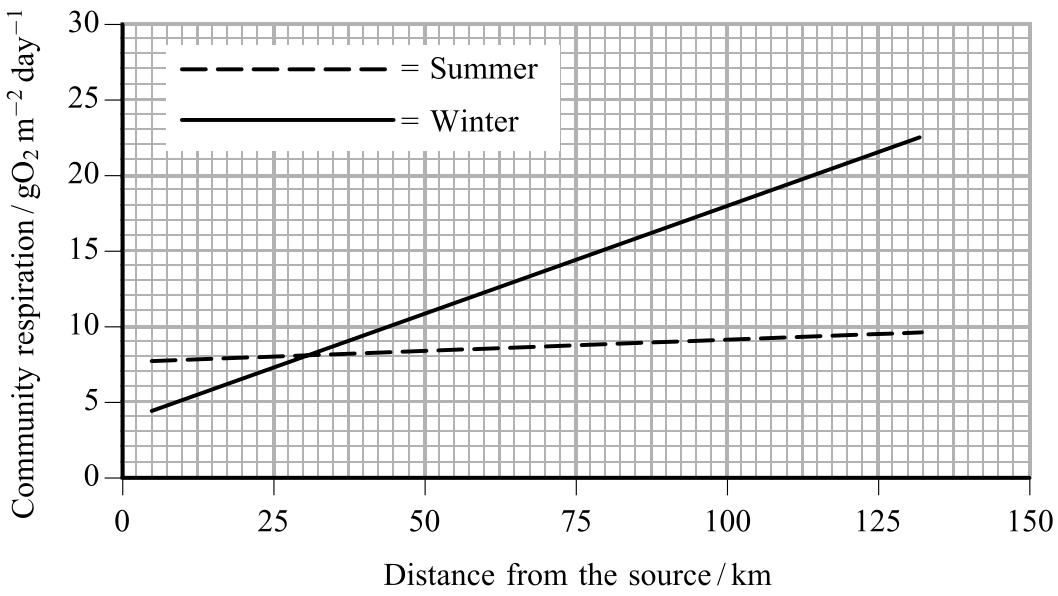
Figure 3 – Community respiration in the Motueka River catchment area.



(a) (i) Explain what is meant by the term **gross primary production**.

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(ii) State **two** abiotic factors that can affect gross primary production in this river system.

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(b) If the input of dead plant material from the catchment area into a river increased, the uptake of oxygen would also increase. Give an explanation for this.

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(c) (i) With reference to Figure 3, compare the trend in community respiration in winter with that in summer for, the Motueka River catchment area.

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(ii) Suggest why community respiration shows this trend.

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QUESTION 3 CONTINUES ON THE NEXT PAGE

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(d) (i) The numbers of carnivorous fish, such as trout, are higher in the Motueka River than in the other two rivers. With reference to Figure 2, suggest reasons for this.

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(ii) With reference to Figure 3, suggest how the population of these carnivorous fish might change in the winter.

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(3) **Q3**

(Total 17 marks)

TOTAL FOR PAPER: 38 MARKS

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