AQA GCSE BIOLOGY (HIGHER) · 8461

BIOLOGY



EXAM QUESTION PACK

4.7.4 TROPHIC LEVELS IN AN ECOSYSTEM (PACK 2)

SCORE	PERCENTAGE
/118	%

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Q1.

The diagram shows the flow of energy through a forest. The figures are in kilojoules of energy per square metre per year.



(a) What percentage of the energy in the trees is passed on as food for the carnivores? Show clearly how you work out your final answer.

_____

_____

_____ per cent

(2)

(b) Give **three** reasons why so little of the energy in the trees is passed on to the carnivores.

1. _____

_____

2. _____

_____

3. _____

_____

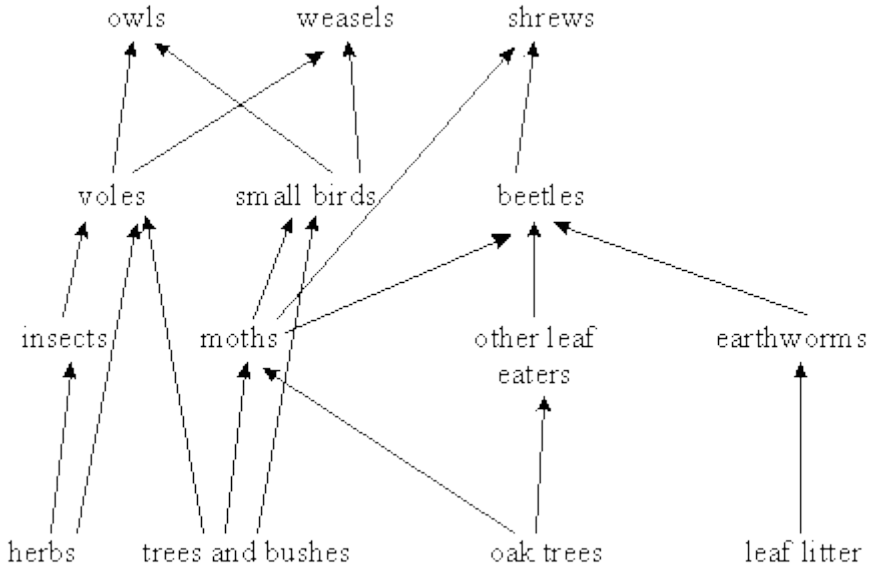
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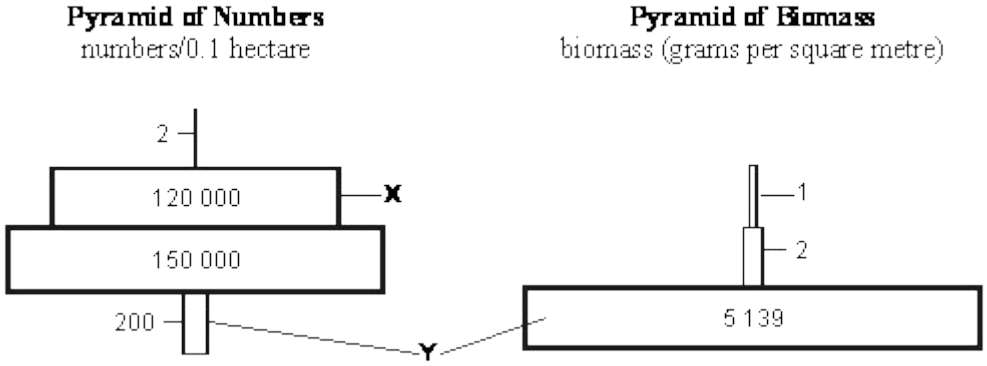
Q2.

The diagram below shows a food web for a wood.

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(a) The diagrams below show a pyramid of the numbers and a pyramid of the biomass for 0.1 hectare of this wood.



(i) Name **one** organism from the level labelled X.

_____

(1)

(ii) Explain, as fully as you can, why the level labelled Y is such a different width in the two pyramids.

_____

_____

_____

_____

(3)

(b) Explain, as fully as you can, what eventually happens to energy from the sun which is captured by the plants in the wood.

_____

_____

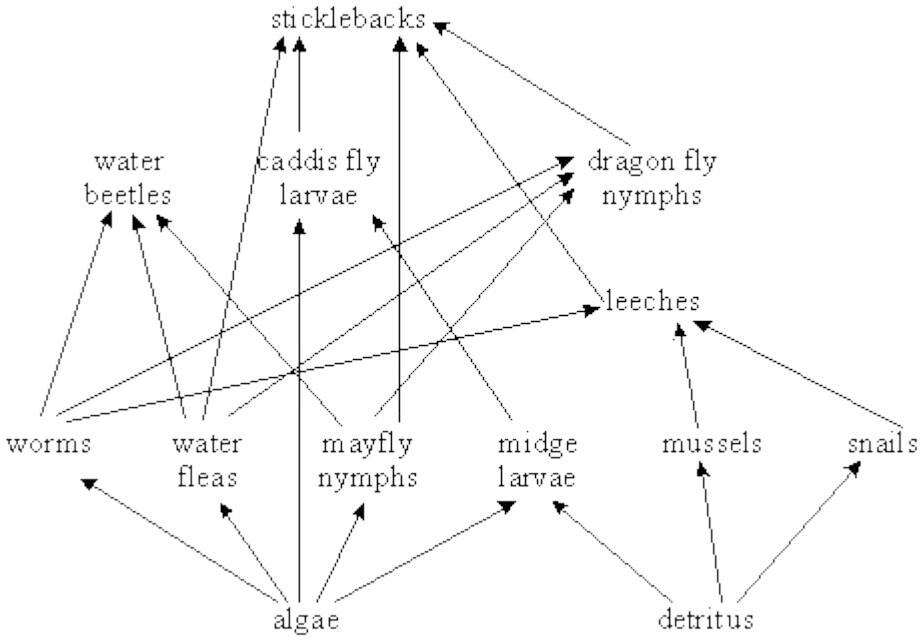
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(10)

(Total 14 marks)

Q3.

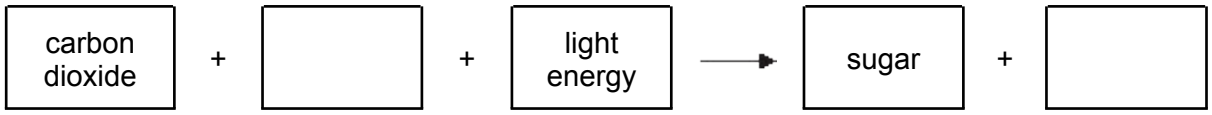
The diagram below shows a food web for some of the organisms which live in a pond.



You may need to use information from the food web to help you to answer the following questions.

(a) The algae photosynthesise. Complete the equation for photosynthesis.

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(2)

(b) Only a small percentage of the Sun's energy captured by the algae is eventually incorporated into the body tissues of the stickleback. Explain, as fully as you can, what happens to the rest of the energy captured by the algae.

_____

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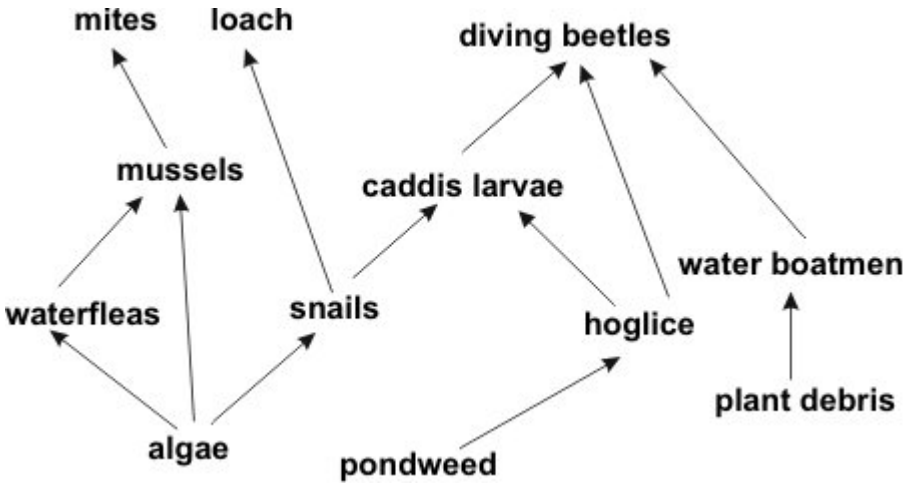
(8)

(Total 10 marks)

Q4.

The diagram below shows a food web for some of the organisms which live in a pond.

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(a) (i) Name **one** secondary consumer in this food web.

_____

(1)

(ii) The algae are small green plants.

Give **three** conditions needed by green plants to produce sugars.

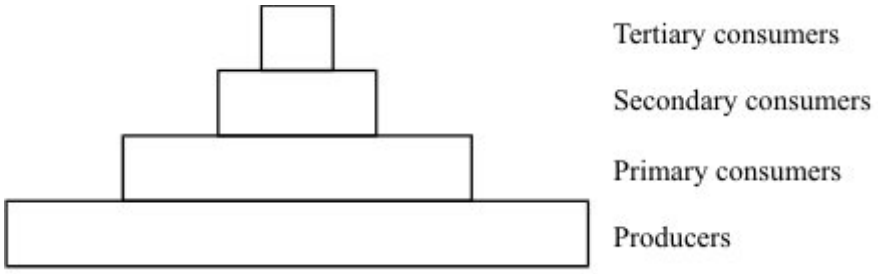
1. _____

2. _____

3. _____

(3)

(b) This is a pyramid of biomass for the organisms in the aquarium.



Some of the biomass of the producers is **not** transferred to the tertiary consumers.

Explain, as fully as you can, what happens to this biomass.

(6)

(Total 10 marks)

Q5.

A gardener pulled up weeds and used them to start a compost heap. The compost heap soon became colonised by large numbers of earthworms and slugs. The gardener then noticed a hedgehog rooting through the compost heap, eating the earthworms and slugs. Every so often the hedgehog stopped to scratch itself. This was because it had large numbers of fleas which fed by sucking the hedgehog's blood.

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(a) Use **only** information from the passage to answer the following.

Construct and label a pyramid of **biomass** for your food chain.

(2)

(b) Gardeners put plant material onto compost heaps so that it will decay. They then put the decayed compost onto soil where they are growing their plants.

Give **three** conditions which are needed for plant material to decay rapidly.

1. _____

2. _____

3. _____

(3)

(Total 5 marks)

Q6.

An oak wood contained the following:

200 oak trees

150 000 primary consumers

120 000 secondary consumers

(a) Draw and label a pyramid of biomass for **this** wood. (Your pyramid does **not** have to be drawn to scale.)

(2)

(b) A scientist estimated the total amount of energy flow through each level of the pyramid per year.

The results were:

Energy absorbed by oak trees	4 600 000 kJ per m^2 per year
Energy in sugar produced by trees	44 000 kJ per m^2 per year
Energy transferred to primary consumers	2 920 kJ per m^2 per year
Energy transferred to secondary consumers	700 kJ per m^2 per year

(i) Calculate the percentage of the energy absorbed by the trees that is transferred to sugar by photosynthesis. Show your working.

Answer _____ %

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(2)

(ii) Suggest **two** reasons why a large proportion of the energy is not transferred to sugar.

1. _____

_____

2. _____

_____

(2)

(iii) Give **three** reasons why some of the energy in the primary consumers is not passed on to the secondary consumers.

1. _____

_____

2. _____

_____

3. _____

_____

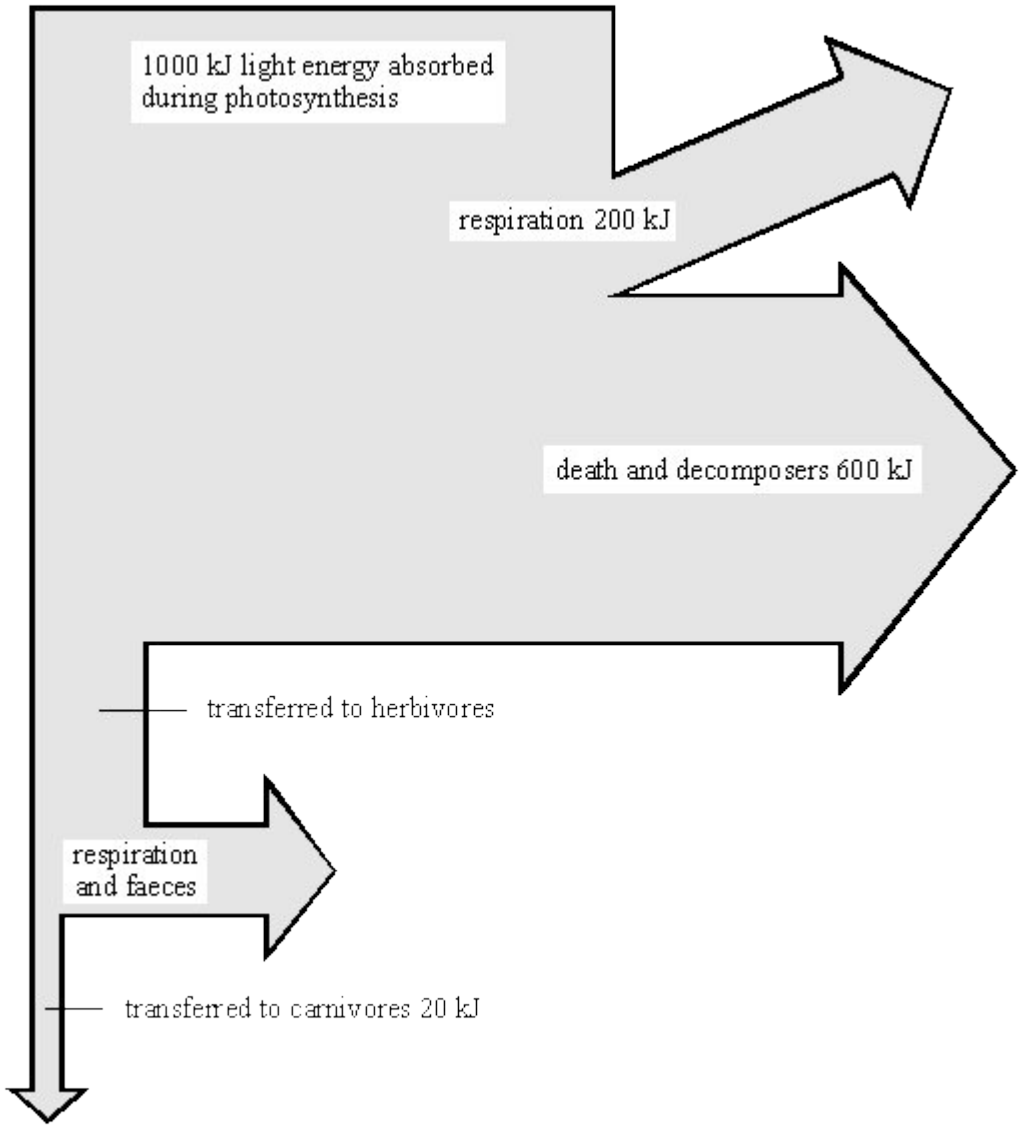
(3)

(Total 9 marks)

Q7.

(a) The diagram shows what happens to each 1000 kJ of light energy absorbed by plants growing in a meadow.

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Use the information from the diagram to calculate:

(i) how much energy was transferred to herbivores;

_____ kJ

(1)

(ii) the percentage of the energy absorbed during photosynthesis that was eventually transferred to carnivores. Show your working.

_____ %

(2)

(b) The table gives the energy output from some agricultural food chains.

FOOD CHAIN	ENERGY AVAILABLE TO HUMANS

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	FROM FOOD CHAIN (kJ PER HECTARE OF CROP)
cereal crop ⇒ humans	800 000
cereal crop ⇒ pigs ⇒ humans	90 000
cereal crop ⇒ cattle ⇒ humans	30 000

Explain why the food chain *cereal crop* ⇒ *humans* gives far more energy than the other two food chains.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(c) The amounts of energy available to humans from the food chain
cereal crop ⇒ *pigs* ⇒ *humans*
can be increased by changing the conditions in which the pigs are kept.

Give **two** changes in conditions which would increase the amount of energy available. In each case explain why changing the condition would increase the available energy.

Change of condition 1 _____

Explanation _____

_____

_____

Change of condition 2 _____

Explanation _____

_____

_____

(4)

(Total 10 marks)

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Q8.

A food chain has four organisms, **A**, **B**, **C** and **D**.

A → B → C → D

The table shows the amount of energy transferred by each organism in one year.

Organism	Energy transferred in kJ per year
A	87 000
B	14 000
C	1600
D	70

Explain, as fully as you can, why organism **D** would transfer much less energy than organism **A**.

_____

_____

_____

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(Total 5 marks)

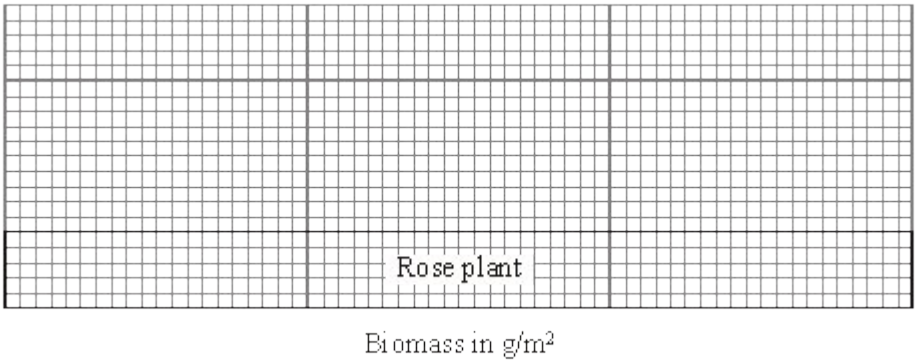
Q9.

Energy is stored in the materials that make up organisms. These materials are called biomass.

Organisms in food chain	Rose plant	→	Greenfly	→	Ladybird	→	Blackbird
Biomass in g/m^2	600		50		10		1

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(a) Complete the pyramid of biomass for this food chain. The rose plant has been done for you. You should draw the rest of the pyramid to the same scale. (5 small squares = 50 g/m^2.)



(3)

(b) What proportion of the energy in a rose plant is transferred to greenfly?

_____

_____

_____

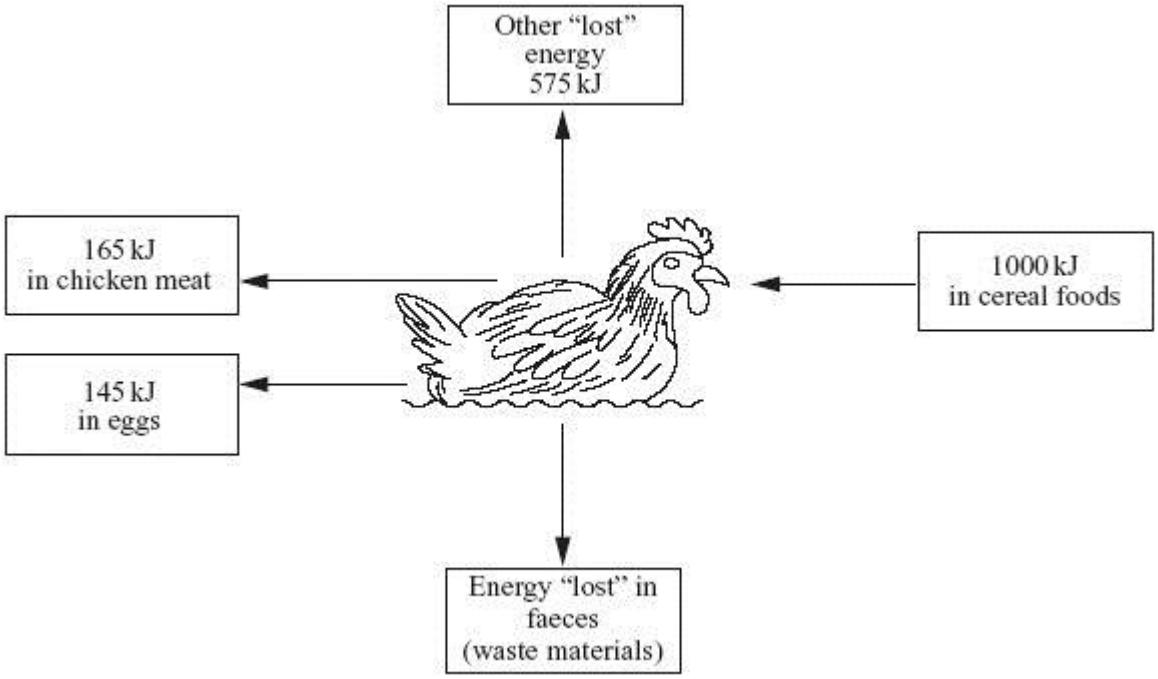
Proportion = _____

(2)

(Total 5 marks)

Q10.

Chickens are kept as farm animals to produce food. Free-range chickens are allowed to feed in a large space outside. The diagram shows how energy supplied in food to a free-range chicken is transferred.



(a) Calculate the amount of energy "lost" in faeces.

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_____

_____

Energy “lost” = _____ kJ

(1)

(b) Some farmers use the battery method. They keep large numbers of chickens in a small indoor space. The food yield from these chickens is higher than that from free-range chickens. Explain why, as fully as you can.

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(Total 5 marks)

Q11.

The information in the table compares two farms. Both are the same size, on similar land, close to one another and both are equally well managed.

Name of farm	Activity	Energy value of food for humans produced in one year	Number of people whose energy requirements can be met by this food
Greenbank Farm	Grows food for humans	3285 million kJ	720
Oaktree Farm	Grows food for animals on the farm which become food for humans	365 million kJ	80

(a) Use this information to work out the average daily human energy requirement in kilojoules (kJ) per day.

_____

_____

Energy requirement = _____ kJ/day

(2)

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(b) The figures show that farms like Greenbank Farm can be nine times more efficient at meeting human food energy requirements than farms such as Oaktree Farm.

(i) The food chain for Greenbank Farm is:

vegetation → humans

What is the food chain for Oaktree Farm?

_____

(1)

(ii) Explain why Greenbank Farm is much more efficient at meeting human food energy requirements.

_____

_____

_____

_____

_____

(3)

(c) The human population has been increasing rapidly throughout this century. It is now about 6 billion and is still growing. What does the information in this question suggest about likely changes in the human diet which may need to occur during the coming century? Explain your answer.

_____

_____

_____

_____

_____

_____

(4)

(Total 10 marks)

Q12.

Compare the efficiency of these two food chains.

Food chain **A** grain → humans

Food chain **B** grain → bullocks → humans

In your answer, make **full use** of the following data.

Food	Consumer	Percentage of available energy

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		transferred as useful energy
Grain	Human	9%
Grain	Bullock	12%
Bullock	Human	10%

One kilogram of grain has 80 000 kJ of available energy.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(Total 4 marks)

Q13.

(a) 1m² of a field gets about 1050MJ of light energy per year.

Only 21 500kJ of energy is stored in the new grass.

(i) How is the energy stored in the new grass?

_____

(1)

(ii) What is the % of light energy stored in the grass?

_____

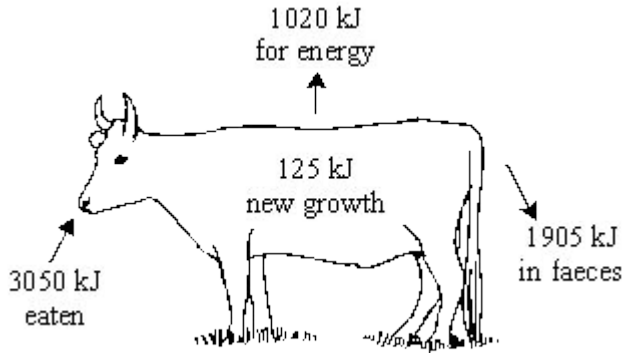
_____

_____

(1)

(b)

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The diagram shows what happens to the energy from grass in part of a field which is grazed by a bullock.

Using information in the diagram suggest why food chains are usually short.

_____

_____

_____

_____

_____

(3)

(c) Many of the animals which from part of our diet are herbivores rather than carnivores. Explain why as fully as you can.

_____

_____

_____

_____

_____

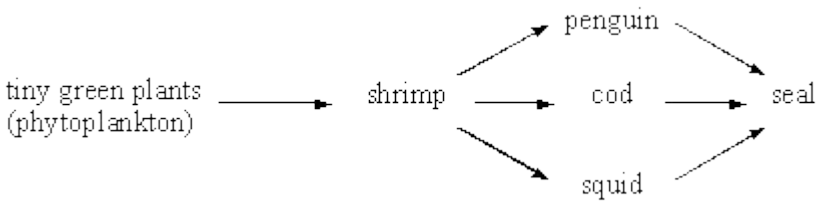
_____

(3)

(Total 8 marks)

Q14.

Scientists have found the following food web in the Antarctic Ocean.



(a) (i) Write down the name of the producer in this web.

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_____

(ii) Write down the names of **two** organisms which are prey in this web.

_____

_____

(3)

(b) Humans are removing large numbers of the cod.
Some scientists argue that this could lead to a decrease in the numbers of squid and penguins.
Others argue that the numbers of squid and penguins will stay the same.

Carefully explain each argument.

Why they might decrease.

_____

_____

_____

Why they might stay the same.

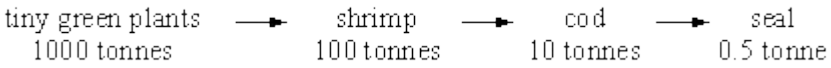
_____

_____

_____

(2)

(c) The following information is about the biomass of the organisms in one of the food chains in the web.



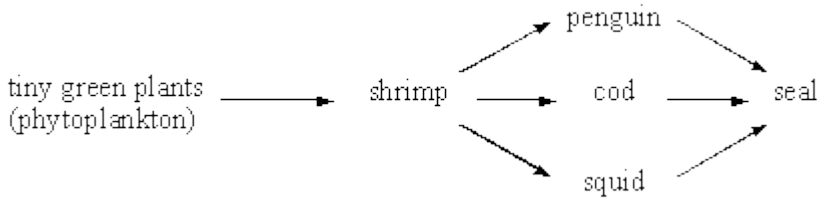
Draw and label a pyramid of biomass for this chain.

(2)
(Total 7 marks)

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Q15.

Scientists have found the following food web in the cold Antarctic Ocean.



(a) Humans are removing large numbers of the cod.

Some scientists argue that this could lead to a decrease in the numbers of squid and penguins.

Others argue that the numbers of squid and penguins will stay the same.

Carefully explain each argument.

Why they might decrease.

_____

_____

_____

(1)

Why they might stay the same.

_____

_____

_____

(2)

(b) The following information is about the biomass of the organisms in one of the food chains in the web.

tiny green plants	→	shrimp	→	cod	→	seal
1000 tonnes		100 tonnes		10 tonnes		0.5 tonne

Draw and label a pyramid of biomass for this chain.

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(2)

(c) Explain, as fully as you can, why the conversion of shrimp biomass into cod biomass is more efficient than that of cod biomass into seal biomass in the cold Antarctic Ocean.

_____

_____

_____

_____

(3)

(d) Boats from many countries fish the Antarctic Ocean. The cod are being overfished. If the numbers of cod are to increase, the population must be carefully managed.

(i) Suggest **two** control measures which would prevent a further drop in numbers,

_____

_____

(2)

(ii) Suggest why **one** of your control measures would be difficult to put into practice.

_____

_____

(1)

(Total 11 marks)

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