



**Chapter 18 Biodiversity and
Ecosystems Exam Pack**

Name: _____

Class: _____

Date: _____

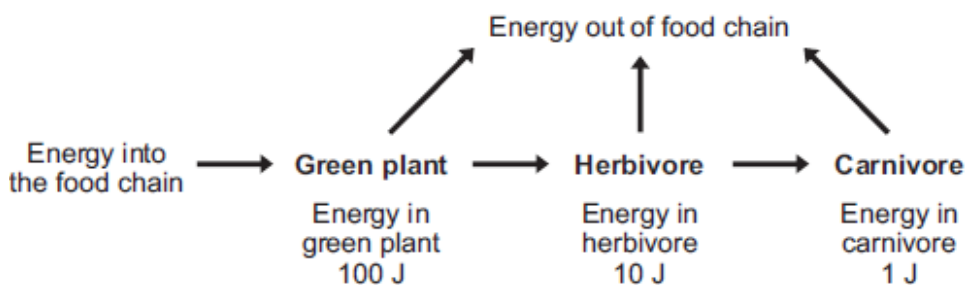
Time: **204 minutes**

Marks: **204 marks**

Comments:

1

The chart shows the amount of energy flowing through a food chain.



(a) (i) The food chain in above is for organisms in a field.

Suggest the names of suitable organisms for this food chain.

Green plant.....

Herbivore.....

Carnivore.....

(3)

(ii) Complete the following sentences.

Energy goes into the food chain as energy.

Energy is stored in living things as energy.

Energy goes out of the food chain as energy.

(3)

(b) (i) Calculate how much energy (J) is lost between the herbivore and the carnivore.

Use the information from the food chain to help you answer the question.

.....

.....

..... J

(1)

(ii) Calculate the percentage of the herbivore's energy lost between the herbivore and the carnivore.

Use the information from the food chain and your answer to part (i) to help you.

.....

.....

.....

..... %

(1)

- (c) (i) Some of the energy in the food an animal eats cannot be used by the animal.

Give **one** reason why.

.....

(1)

- (ii) Name the process animals use to release energy from the food that they have absorbed.

.....

(1)

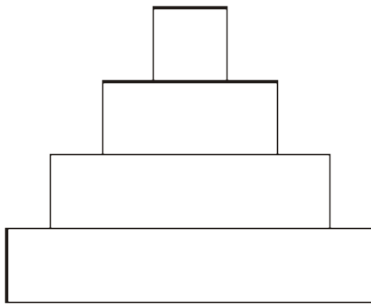
(Total 10 marks)

2

This is a simple food chain.

Lettuce plant → Slug → Frog → Heron

The diagram shows a pyramid of biomass for this food chain.



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.....
.....
.....

- (a) Write the names of the organisms in the food chain on the correct lines next to the pyramid of biomass.

(1)

- (b) (i) The slug obtains its energy from the lettuce plant. What is the source of energy for the lettuce plant?

.....

(1)

- (ii) What is the function of chlorophyll in a lettuce plant?

.....

(1)

- (iii) The slugs ate some lettuce plants which contained 1620 kJ of energy. Only 10 per cent of this energy is used by the slugs for growth. Use the formula to calculate how much energy can be used by the slugs for growth. Show clearly how you work out your final answer.

$$\text{Amount of energy} = \frac{(\text{Percentage of energy used by slugs}) \times (\text{Amount of energy in lettuce})}{100}$$

.....

.....

.....

Amount of energy = kJ

(2)
(Total 5 marks)

3

Copper compounds are found in water that has drained through ash from power stations. Invertebrate animals are used to monitor the concentration of copper compounds in water. First, scientists must find out which invertebrate animals can survive in a range of concentrations of copper compounds.

This is how the procedure is carried out.

- Solutions of different concentrations of a copper compound are prepared.
- Batches of fifty of each of five different invertebrate species, **A**, **B**, **C**, **D** and **E**, are placed in separate containers of each solution.
- After a while, the number of each type of invertebrate which survive at each concentration is counted.

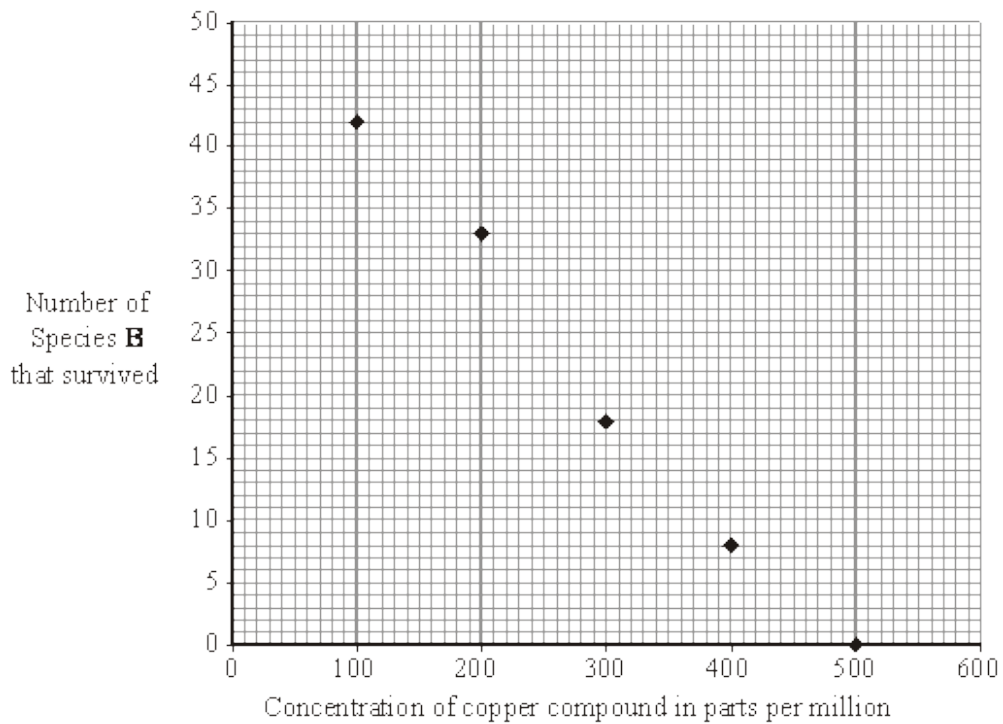
- (a) Give **two** variables that should be controlled in this investigation so that the results are valid.

1

2

(2)

(b) The graph below shows the results for species **B**.

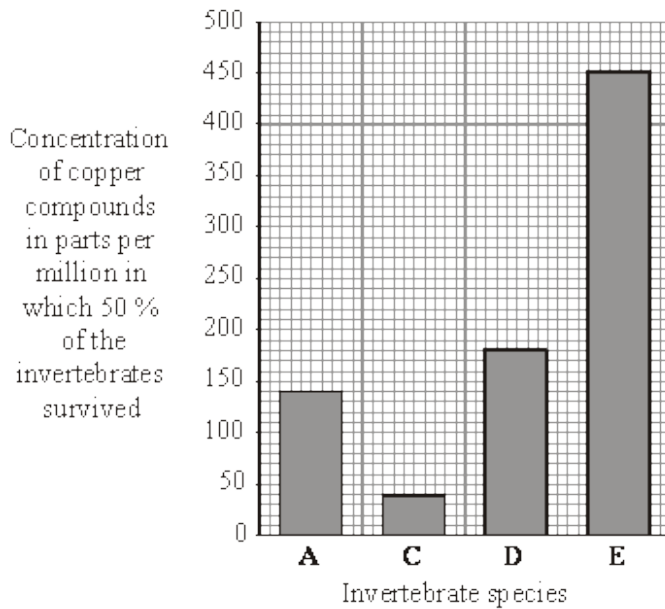


Use the graph to find the concentration of copper compounds in which 50% of Species **B** survived. To obtain full marks you must show clearly on the graph how you obtained your answer.

Concentration parts per million

(2)

(c) The graph below shows the results of the tests on the other four invertebrate species.



(i) Which species, **A**, **C**, **D** or **E**, is most sensitive to the concentration of copper in the water?

.....

Give the reason for your answer.

.....

.....

(1)

(ii) It is often more convenient to use invertebrates rather than a chemical test to monitor water for copper.

Suggest **one** explanation for this.

.....

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.....

.....

(2)

(Total 7 marks)

4 A student is growing cabbages in a garden.

There are a lot of snails eating the cabbages.

The student saw a bird eat a snail.

The student drew a food chain.

(a) (i) In the space below each plant or animal, write whether it is a **consumer** or a **producer**.



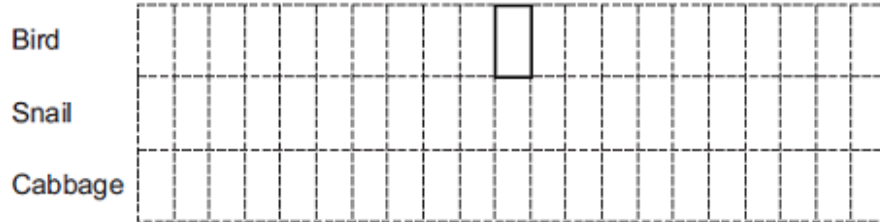
(2)

- (ii) The student estimated that the mass of the bird was 100 g, the total mass of the snails was 500 g and the total mass of the cabbages was 1900 g.

Complete the pyramid of biomass (**Figure 1**) for the food chain, using the values given.

The bird has been done for you.

Figure 1



(3)

- (iii) Biomass decreases at each stage of the food chain because biomass is broken down to release energy for the organism.

Give the name of the process that releases energy from biomass.

.....

(1)

- (b) The student did an investigation to estimate the total number of snails in the garden.

Figure 2



The student collected as many snails as she could find in the garden.

She counted the snails and put a dot of white paint on their shells (**Figure 2**). She then released the snails back into the garden.

One week later she collected as many snails as she could find in the garden.

Her results are shown in the table below.

	Total number of snails collected	Number of snails with marked shells
First collection	60	
Second collection	30	18

- (i) Calculate the total number of snails in the garden.

Use the equation to help you.

$$\text{Total number of snails} = \frac{\text{Total number of snails in the first collection} \times \text{Total number of snails in the second collection}}{\text{The number of snails with marked shells in the second collection}}$$

.....

.....

.....

.....

Total number of snails =

(2)

- (ii) Suggest why putting white dots on snails might affect the number of snails collected and change the total number of snails calculated.

.....

(1)
(Total 9 marks)

5 Figure 1 shows a food chain containing three organisms.

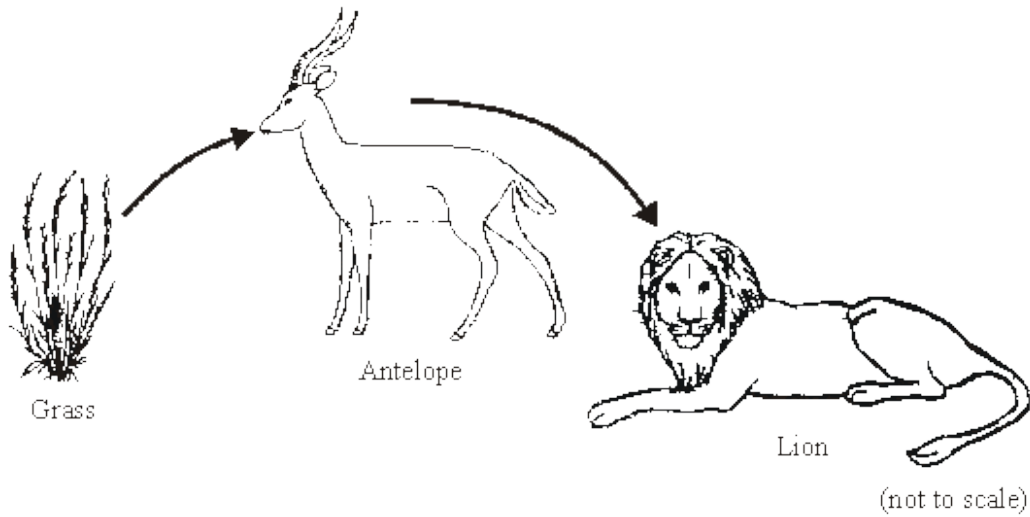


Figure 1

- (a) (i) In this food chain, name:
the predator;
- the prey.

(2)

- (ii) What is the source of energy for the grass?

Draw a ring around **one** answer.

carbon dioxide light nitrates water

(1)

- (iii) **Figure 2** shows a pyramid of biomass for the organisms in **Figure 1**.

Write the names of the organisms on the correct lines in **Figure 2**.

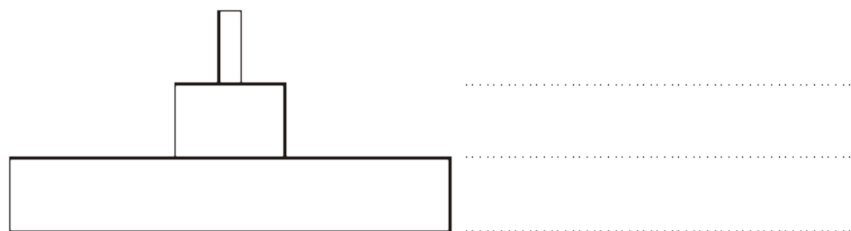


Figure 2

(1)

(b) Waste materials, like faeces from the animals, will decay,

(i) What sort of organisms cause decay?

.....

(1)

(ii) **Three** of the following conditions help decay to occur rapidly.

Which conditions do this?

Draw a ring around each of the **three** answers.

aerobic anaerobic cold dry moist warm

(3)

(iii) The list below gives four substances. Two of these substances are produced by decay and can be used by the grass.

Which **two** substances are these?

Tick (✓) **two** boxes.

Carbon dioxide

Mineral salts

Oxygen

Protein

(2)

(Total 10 marks)

6

Methane is a greenhouse gas. Methane contributes to global warming.

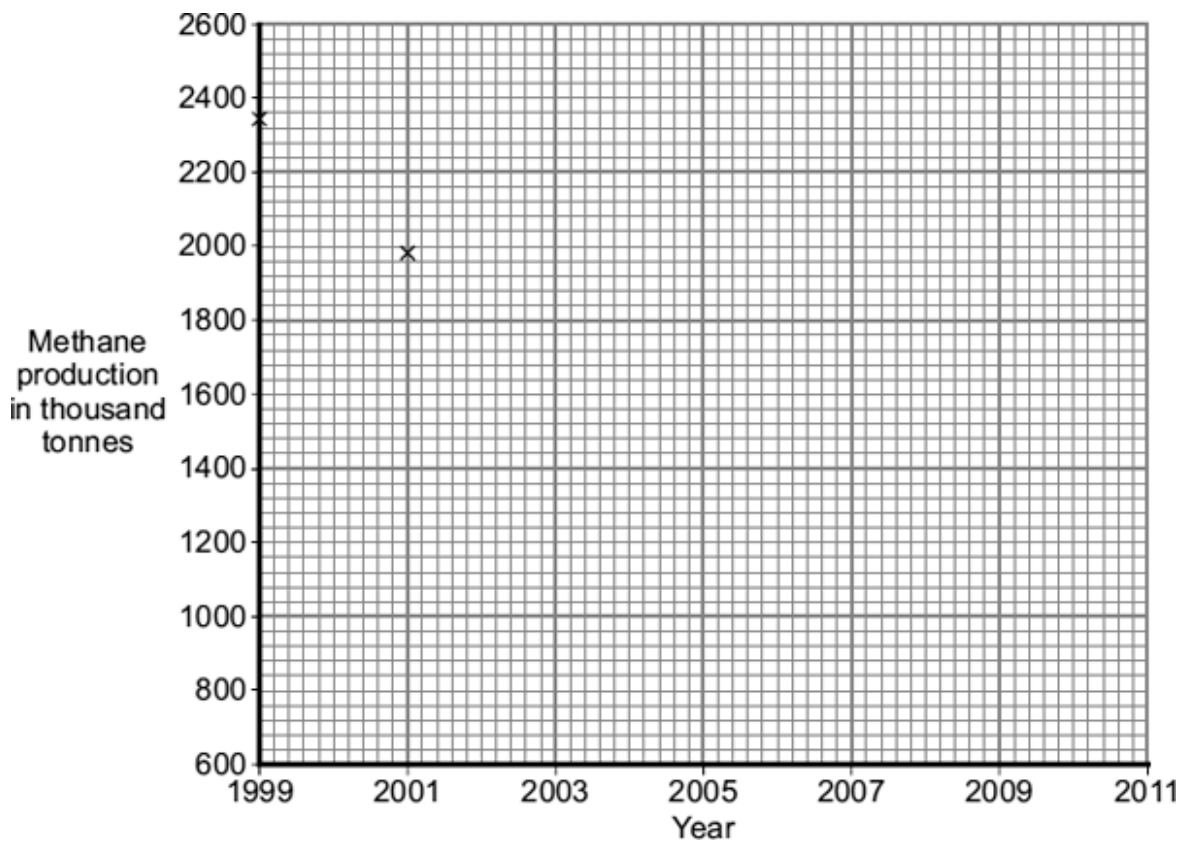
The data in the table shows emissions caused by non-agricultural sources (eg landfill sites) in the UK between 1999 and 2009.

	Year					
	1999	2001	2003	2005	2007	2009
Methane production in thousand tonnes	2348	1980	1600	1400	1280	1220

- (a) (i) Use the data to plot a graph to show how the production of methane from non-agricultural sources changed between 1999 and 2009.

Draw a smooth line of best fit on your graph.

The first two points have been plotted for you.



(3)

(ii) Describe the pattern shown in the graph.

.....
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.....
.....

(2)

(b) In 1997, 37 countries made an agreement to reduce greenhouse gas emissions.

What was the name of this agreement?

Draw a ring round the correct answer.

Kyoto Protocol

United Nations Protocol

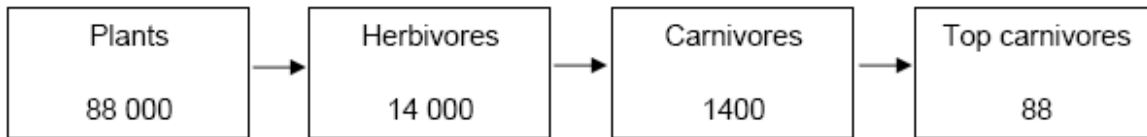
Global Summit

(1)

(Total 6 marks)

7

The diagram shows a food chain in a pond. The figures show the amounts of energy in each type of organism, in kilojoules per m³ of pond per year.



(a) In the space below, draw a pyramid of biomass for this food chain. Label your drawing with the names of the organisms.

(2)

(b) (i) In the food chain, how much energy is lost between herbivores and carnivores?

.....
..... kJ/m³

(1)

(ii) Suggest what happens to the energy that is lost.

.....
.....

(1)

(Total 4 marks)

8

Environmental scientists study the levels of pollution in lakes and rivers. They decide how dangerous the pollution is to organisms living in or around the water.

(a) Water pollution is often caused by chemicals used as fertilisers.

Complete the sentences.

When it rains, fertilisers wash off fields and into rivers or lakes.

This is called These fertilisers make water plants grow rapidly. The plants become overcrowded and die.

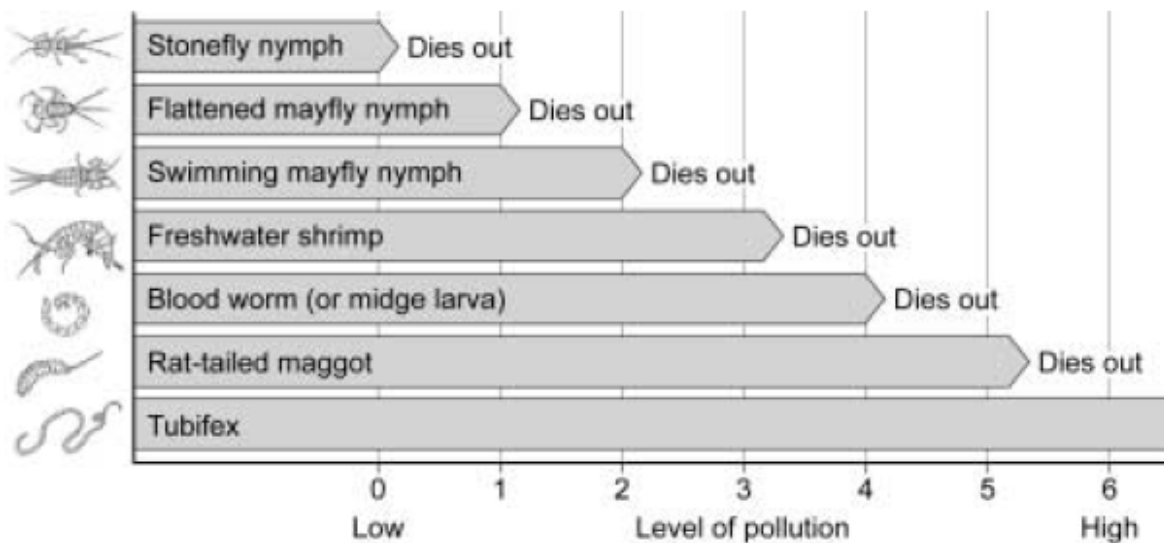
Bacteria cause the dead plants to decay and use up from the water.

This complete process is called

(3)

(b) Some students were asked to study the pollution levels in a stream running through the school grounds.

They were given the chart shown below.



Describe how the students would use the information in the chart to determine how polluted the stream is.

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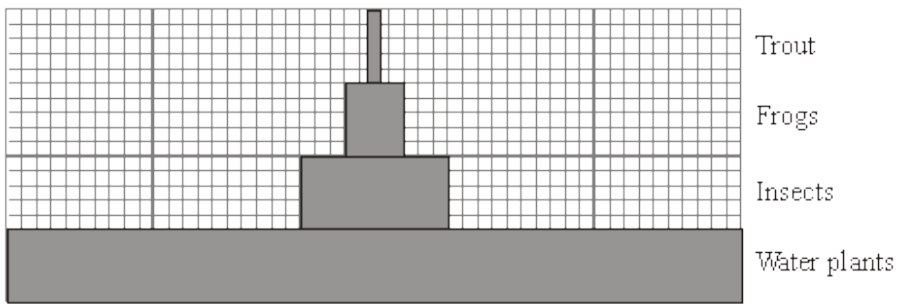
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(4)
(Total 7 marks)

9

The diagram shows a pyramid of biomass drawn to scale.



(a) What is the source of energy for the water plants?

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(1)

(b) The ratio of the biomass of water plants to the biomass of insects is 5 : 1.

Calculate the ratio of the biomass of insects to the biomass of frogs.

Show clearly how you work out your answer.

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ratio = : 1

(2)

(c) Give **two** reasons why the biomass of the frog population is smaller than the biomass of the insect population.

1

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2

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(2)

(d) Some insects die.

Describe how the carbon in the dead insect bodies may be recycled.

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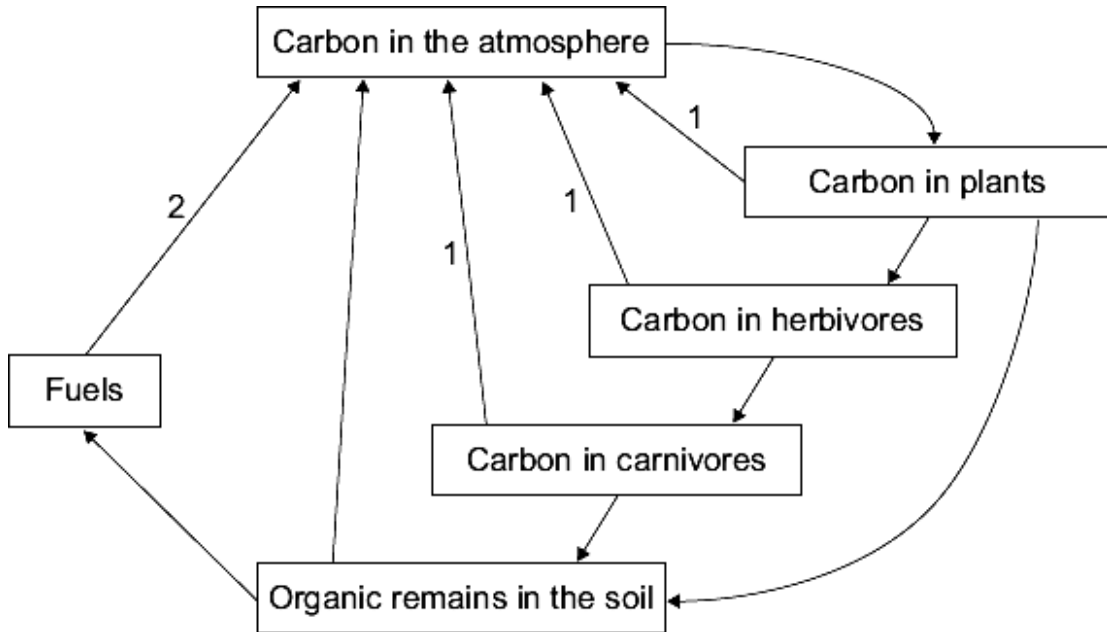
(4)

(Total 9 marks)

10

Carbon is an essential element in all living organisms. Carbon is found in many compounds.

(a) The diagram shows the carbon cycle.



(i) Name process 1.

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(1)

(ii) Name process 2.

.....

(1)

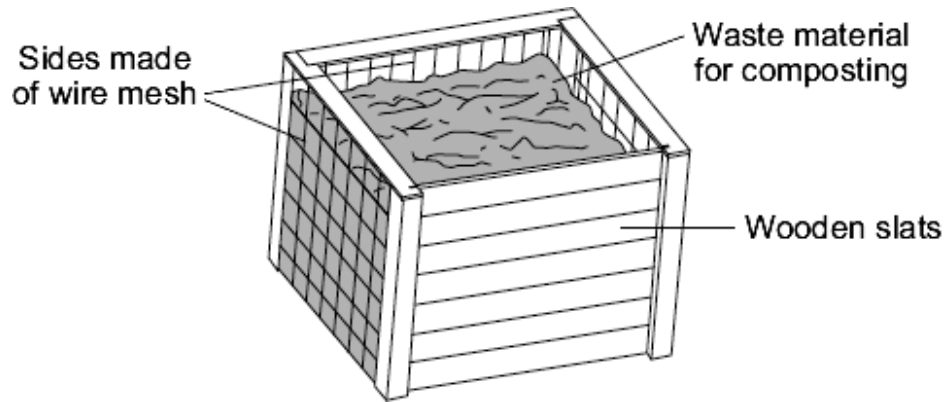
(iii) Name a group of organisms that break down organic remains in the soil.

.....

(1)

(b) Household waste can be made into compost. The compost is used in gardens.

The diagram shows a compost heap.



What conditions must the waste be kept in to make sure that it breaks down into compost?

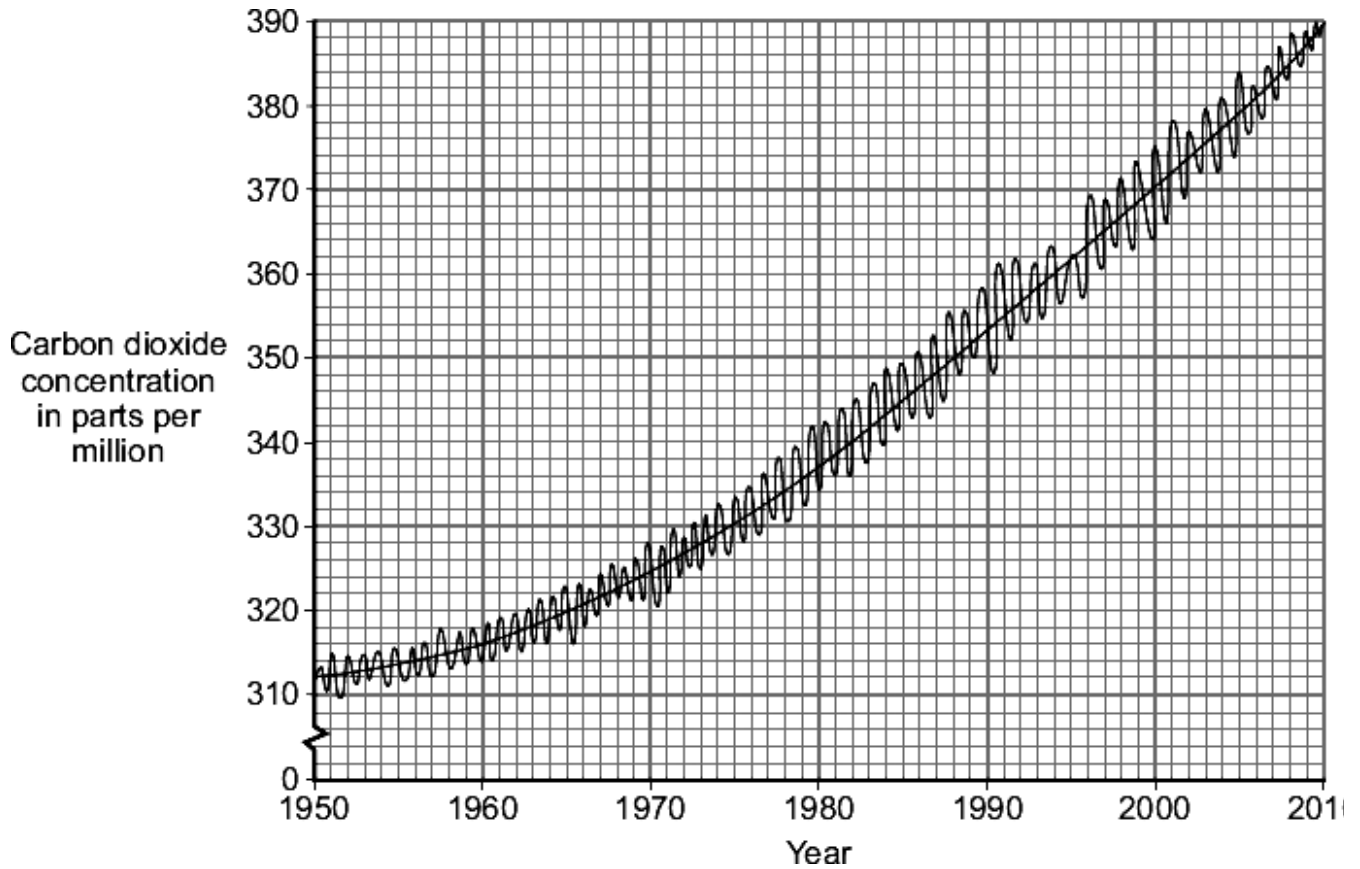
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(3)

- (c) The graph shows the changes in atmospheric carbon dioxide concentration measured at Mauna Loa, Hawaii, between 1950 and 2010.



Some scientists believe that increased carbon dioxide concentration in the atmosphere is linked to global warming.

Suggest why other scientists think that the evidence in the graph is not enough to support a link between carbon dioxide concentration and global warming.

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(3)
(Total 9 marks)

11

(a) 1m^2 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?

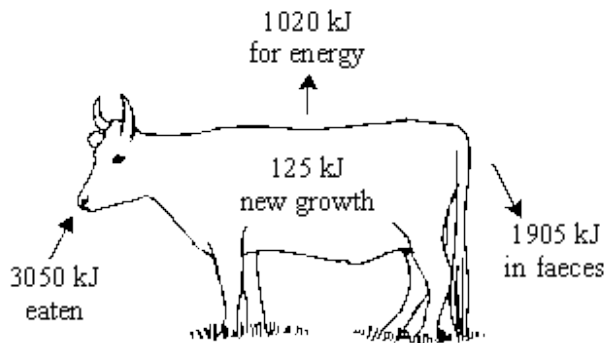
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(1)

(b)



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.

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(3)

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

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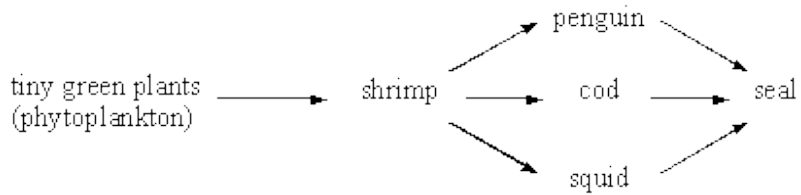
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(3)
(Total 8 marks)

12

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



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

.....

- (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.

.....

.....

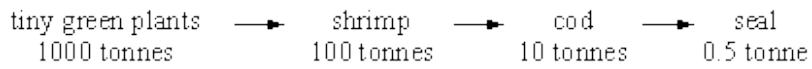
.....

Why they might stay the same.

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.....
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(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)

13

Many people are concerned about the effect we are having on our environment.

Making and using products can increase greenhouse gas emissions.

- (a) (i) Name **one** greenhouse gas produced from combustion of fuels in power stations.

.....

(1)

- (ii) Name a different greenhouse gas that is made during decomposition in landfill sites.

.....

(1)

- (iii) In 2008, 37 countries agreed to reduce greenhouse gas emissions by 2012.

What was the name of this agreement?

.....

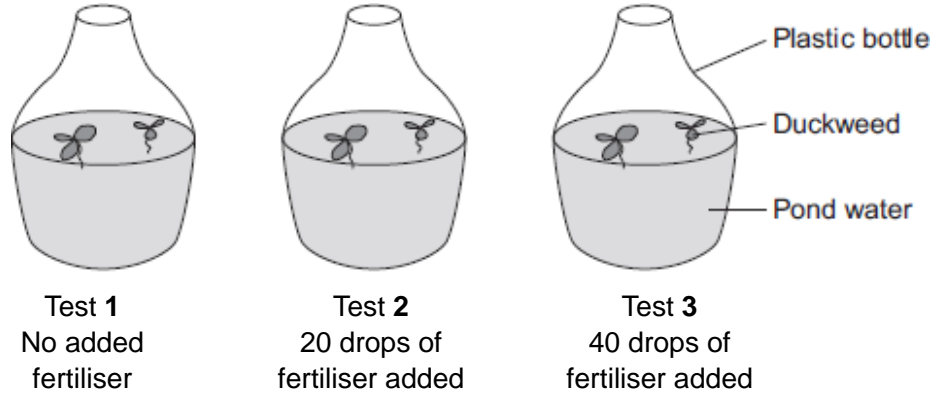
(1)

(b) Some greenhouse gases are released from the overuse of fertilisers.

Overuse of fertilisers also causes eutrophication.

A farmer wanted to investigate the possible effect of fertilisers on the health of the animals and plants in his pond.

The apparatus the farmer used is shown in the diagram.



Duckweed is a plant found on the surface of ponds. The farmer set up three tests:

- Test 1 – no fertiliser added
- Test 2 – 20 drops of fertiliser added
- Test 3 – 40 drops of fertiliser added.

The farmer counted the number of duckweed leaves in each test at the start of the investigation (Day 0).

He counted the number of duckweed leaves every 2 days.

His results are shown in the table.

Day	Number of duckweed leaves		
	Test 1	Test 2	Test 3
0	19	18	19
2	30	34	40
4	42	50	59
6	58	69	81
8	78	92	108

(b) (i) Why did the farmer set up Test 1?

.....

(1)

(ii) Describe the patterns shown by the data in the table.

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.....
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.....

(2)

(iii) There was an accident on the farm and fertiliser drained in to the farmer's pond.
Describe the effect the fertiliser could have on the pond.

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(4)

(Total 10 marks)

14

(a) Greenhouse gases are produced by many types of human activity.

Give **one** human activity that produces lots of:

(i) carbon dioxide

.....

(1)

(ii) methane

.....

(1)

(iii) nitrous oxide.

.....

(1)

(b) Greenhouse gases can cause global warming. Explain how.

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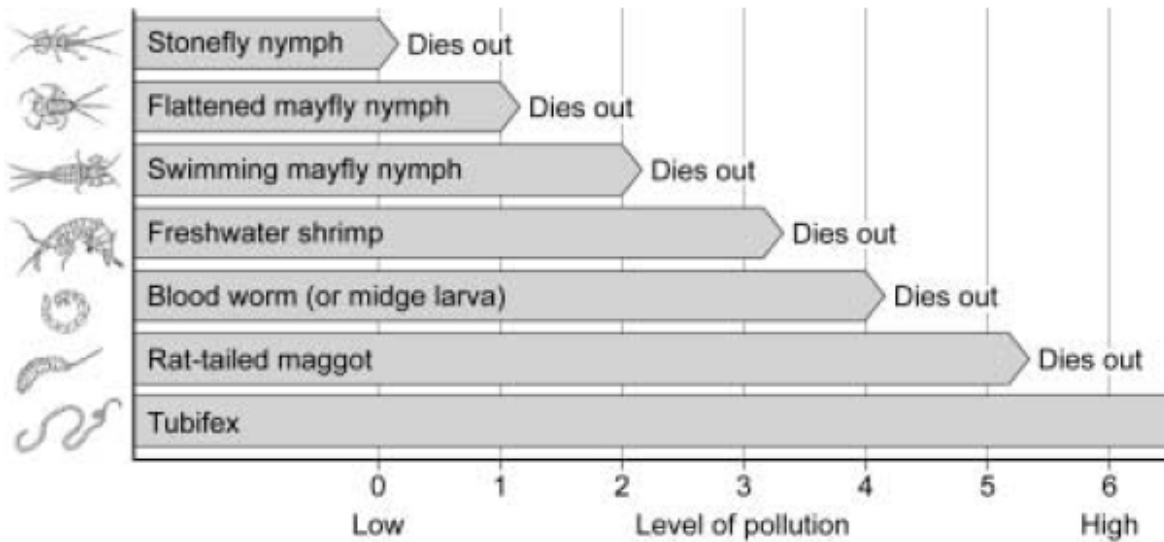
(2)
(Total 5 marks)

15

Environmental scientists study the levels of pollution in lakes and rivers and decide how dangerous the pollution is to organisms living in or around the water.

(a) Some students were asked to study the pollution levels in a stream running through the school grounds.

They were given the chart shown below.



Describe how the students would use the information in the chart to determine how polluted the stream is.

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(4)

(b) At one point in the stream, students found freshwater shrimps and bloodworms, but no mayfly nymphs.

Suggest the level of pollution at that point in the stream.

.....

(1)

(c) In part of the stream near a farm, all of the organisms had died because of eutrophication.

Explain the process of eutrophication caused by fertiliser leaching.

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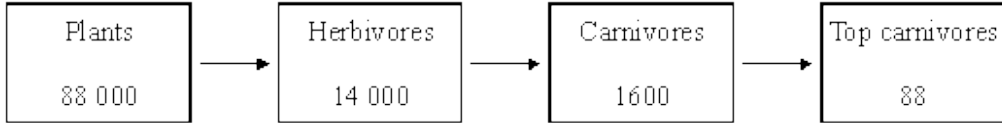
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(4)

(Total 9 marks)

16

The diagram shows a food chain in a pond. The figures show the amounts of energy in each type of organism, in kilojoules per m² of pond per year.



(a) Calculate the percentage of the energy in the plants that is passed to the top carnivores. Show clearly how you work out your final answer.

.....
.....
.....

Answer %

(2)

(b) In the space below, draw a pyramid of biomass for this food chain. Label your drawing with the names of the organisms.

(2)

(c) If humans ate organisms from this food chain, it would be more efficient to eat plants than to eat herbivores. Why is this?

.....
.....
.....

(1)

(Total 5 marks)

17

The table shows the biomass of types of organisms in a pond.

Organism	Biomass units
Plants	800
Herbivores	160
Carnivores	64
Top carnivores	16

(a) Use the data in the table to draw a pyramid of biomass on the grid below.

Use a scale of 16 biomass units to one small square.

Use the space above the grid to show how you calculate the values for each step.



(4)

(b) Suggest **one** reason why the biomass of the top carnivores is much smaller than the biomass of plants in the pond.

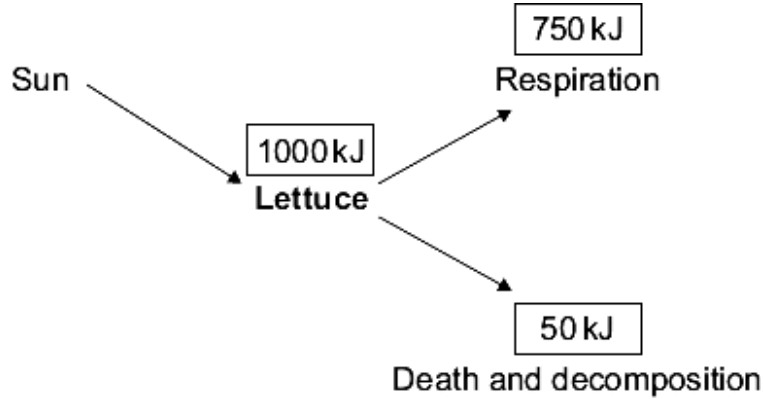
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(1)

(Total 5 marks)

The diagram shows some of the energy transfers in a lettuce plant.



- (a) What percentage of the energy absorbed by the lettuce is available to a rabbit that eats it?

Show clearly how you work out your answer.

.....

Percentage of energy absorbed = %

(2)

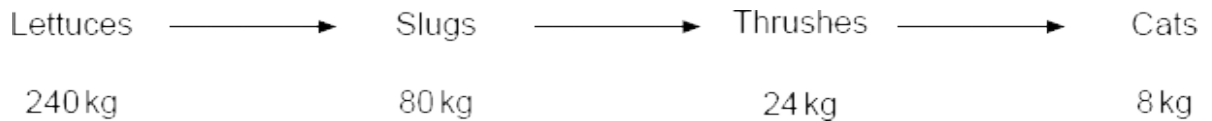
- (b) Only 10% of the energy that a rabbit absorbs from the lettuce is used by the rabbit for growth.

Why do rabbits **not** use all of the energy absorbed from the lettuce for growth?

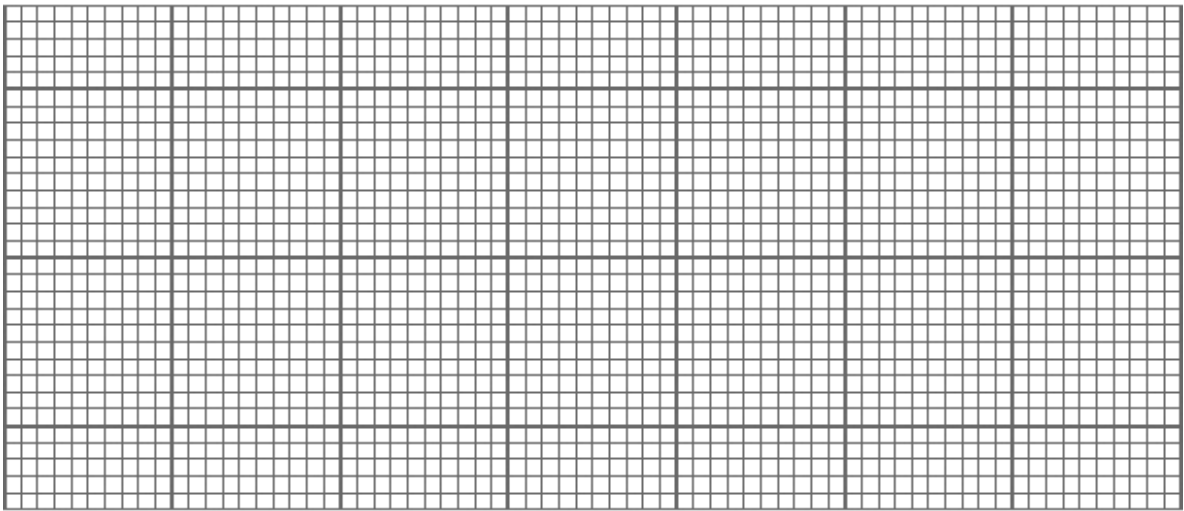
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(3)

- (c) The food chain and values of biomass below are for organisms in a different habitat.



On the grid, draw and label a pyramid of biomass for this food chain, to scale.



(3)
(Total 8 marks)

19

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Global warming affects the environment.



© Thomas Pickard/iStock/Thinkstock

Global warming is caused by greenhouse gases in the atmosphere.

Describe the ways in which greenhouse gases may be produced by human activity.

In your answer you should include names of greenhouse gases.

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Extra space

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(Total 6 marks)

20

Living organisms on the Earth can be put into food chains.

(a) Describe how energy enters a food chain.

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.....

(2)

(b) Describe how energy leaves a food chain.

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(2)

(c) Food chains rarely contain more than five different organisms.

Give **two** reasons why.

1

.....

2

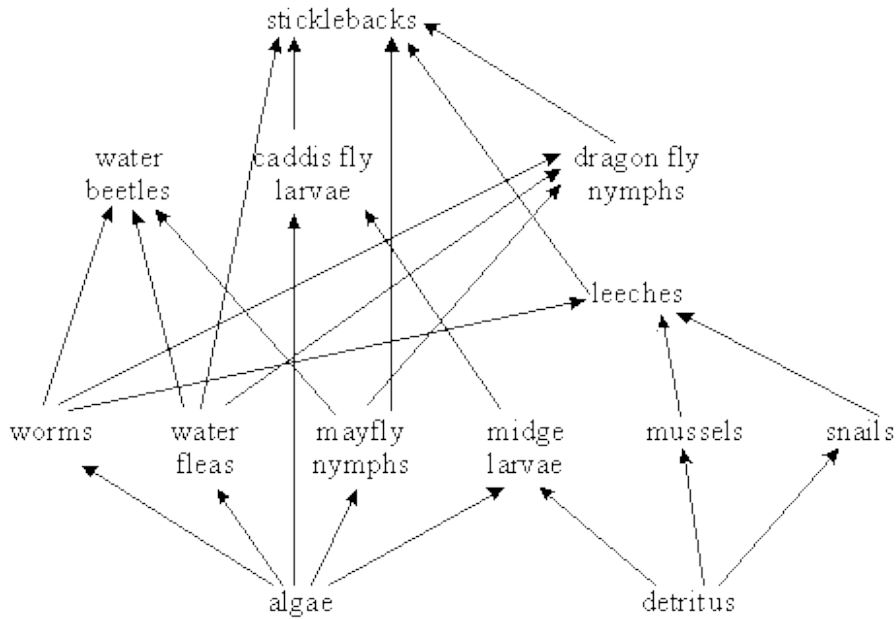
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(2)

(Total 6 marks)

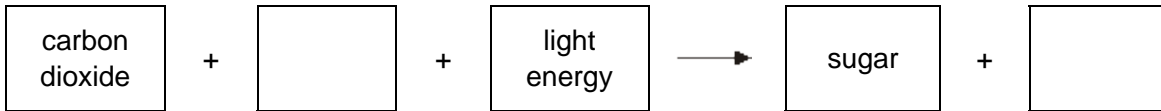
21

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.



(2)

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

- 1
-
- 2
-
- 3
-

(3)

(Total 5 marks)

23

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.

(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.

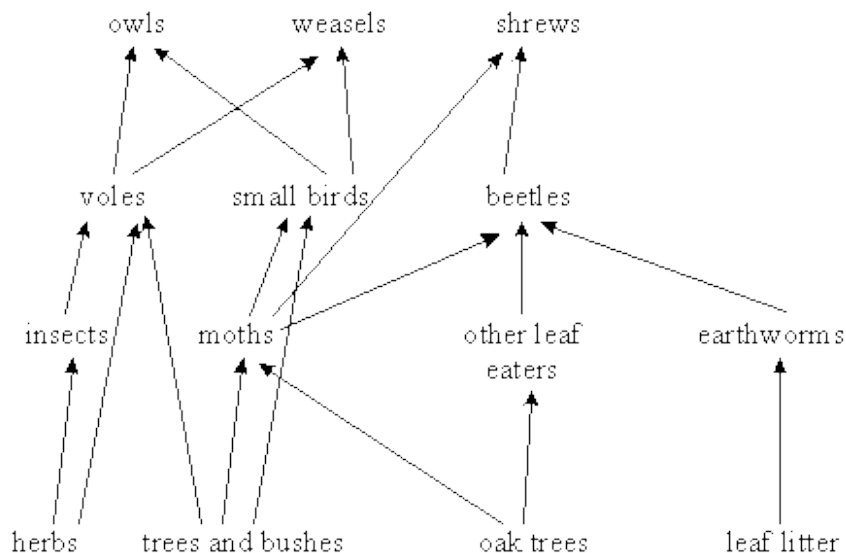
Give **three** conditions which are needed for plant material to decay rapidly.

- 1
- 2
- 3

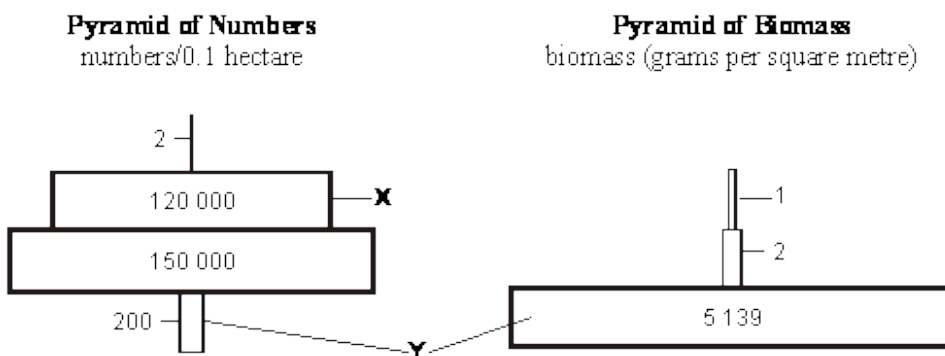
(3)

(Total 5 marks)

The diagram below shows a food web for a wood.



(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)

25

Environmental scientists use indicator species to measure the levels of pollution in the air and in rivers.

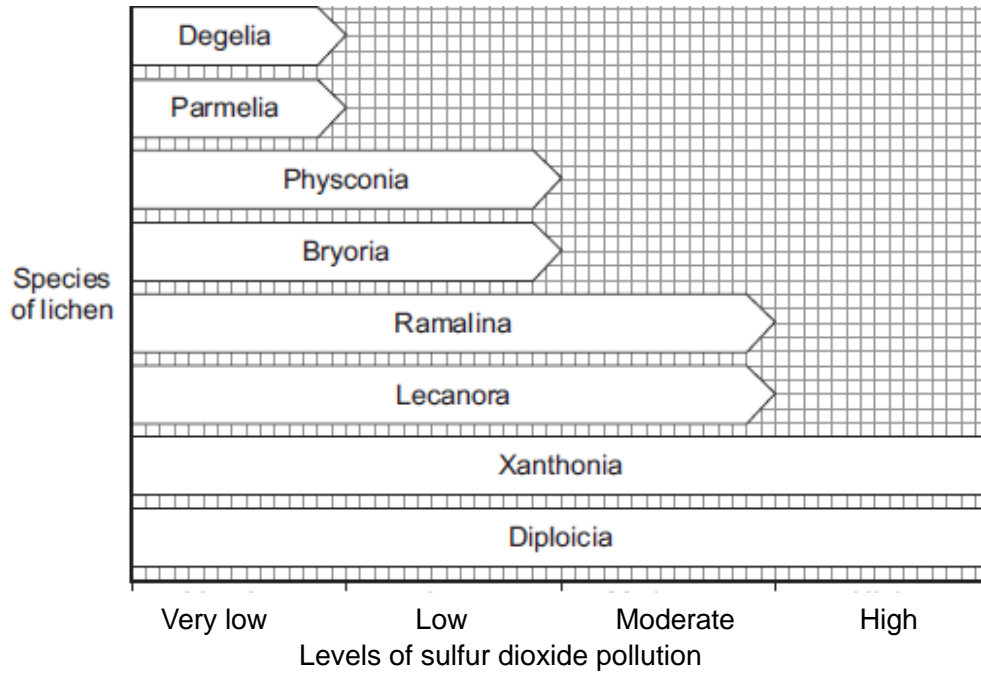
(a) Name **one** indicator species for water pollution.

.....

(1)

(b) Lichens are indicators of air pollution.

The chart shows the level of sulfur dioxide pollution different lichens can survive in.



(i) An environmental scientist is investigating pollution in a forest near a factory. Describe how the scientist would use the chart to find the level of pollution in the forest.

.....

.....

.....

.....

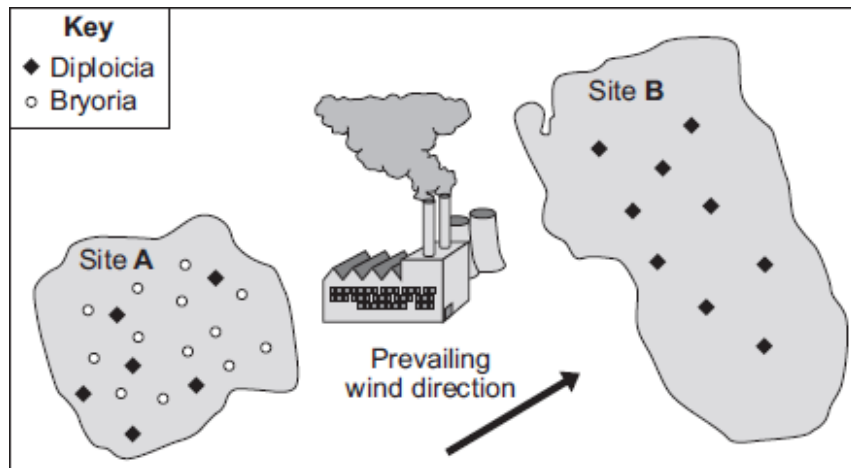
.....

.....

.....

(4)

- (ii) The diagram shows the position of the factory and the lichens found near the factory.



What is the evidence that the factory is causing the pollution?

.....

.....

.....

.....

.....

(2)

- (c) Some types of pollution are also greenhouse gases.

- (i) Describe the human activities that are leading to increased levels of each of the **three** main greenhouse gases listed below.

Carbon dioxide

.....

Methane

.....

Nitrous oxide

.....

(3)

- (ii) Explain how greenhouse gases are causing an increase in the temperature of the Earth.

.....

.....

.....

.....

(2)
(Total 12 marks)

26

A student is growing cabbages in a garden.

There are a lot of snails eating the cabbages.

The student did an investigation to estimate the total number of snails in the garden.

Figure 1



The student collected as many snails as she could find in the garden.

She counted the snails and put a dot of white paint on their shells (**Figure 1**). She then released the snails back into the garden.

One week later she collected as many snails as she could find in the garden.

Her results are shown in the table below.

	Total number of snails collected	Number of snails with marked shells
First collection	61	
Second collection	41	

(a) (i) The estimated total number of snails in the garden was 104.

Calculate the number of snails with marked shells in the second collection.

Use the equation to help you.

$$\text{Estimated total number of snails} = \frac{\text{Total number of snails in the first collection} \times \text{Total number of snails in the second collection}}{\text{The number of snails with marked shells in the second collection}}$$

.....

.....

.....

.....

.....

Number of snails with marked shells in the second collection =

(3)

- (ii) Suggest how she could estimate the total mass of snails in the garden using five of the snails she collected.

.....

.....

.....

.....

.....

(3)

- (b) The student saw a bird eat one of the snails.

The mass of the bird was 100 g.

She made a food chain for cabbages, snails, and the bird.

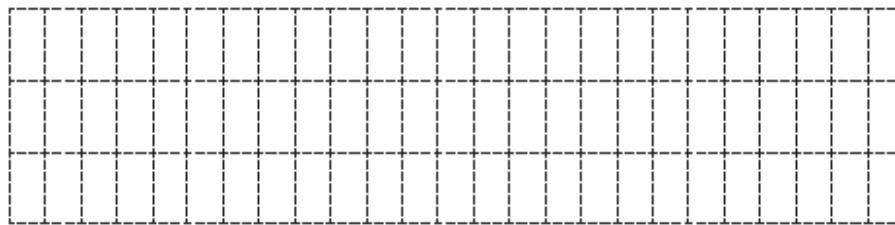
She then estimated the mass of the cabbages and the mass of the snails.

The estimated mass of the snails was 700 g.

The estimated mass of the cabbages was 2300 g.

- (i) Draw and label a pyramid of biomass in **Figure 2** for the food chain, using the values given.

Figure 2



(3)

(ii) 10% of the biomass in each stage of a food chain is passed on to the next stage.

The student concluded that for the bird in the garden to have a mass of 100 g:

- the snails must eat other plants as well as cabbages
- the bird must eat other animals as well as snails.

Use the information from part **(b)** to suggest the reasons for this conclusion.

.....

.....

.....

.....

.....

.....

(4)
(Total 13 marks)

Mark schemes

1	(a) (i)	any suitable green plant	1
		any suitable herbivore	1
		any suitable carnivore	
		<i>in this order</i>	
		<i>accept any suitable omnivore for this mark</i>	
		<i>answers supplied must be sensible. Ignore exotic species</i>	1
	(ii)	(sun)light	
		<i>in this order</i>	1
		chemical	
		<i>chemical potential energy (cpe)</i>	1
	heat		
	<i>accept thermal / chemical / kinetic</i>	1	
(b) (i)	9(J)	1	
(ii)	90(%)		
	<i>allow ecf</i>	1	
(c) (i)	any one from:		
	<ul style="list-style-type: none">• some food is not digested• some food is lost as faeces.		
	<i>Allow lost as waste / excreted</i>	1	
(ii)	respiration		
	<i>ignore 'aerobic' and 'anaerobic'.</i>	1	
		[10]	
2	(a) <u>In sequence:</u>		
	heron frog slug lettuce	1	

- (b) (i) light / sun
ignore photosynthesis / respiration
cancel mark if water / ions etc given
*do **not** accept heat* 1
- (ii) traps / absorbs light
accept energy for light
*do **not** accept collects / attracts*
*do **not** accept 'traps sun'* 1
- (iii) 162
if correct answer, ignore working / lack of working

$$\frac{10 \times 1620}{100} \text{ for 1 mark}$$
 2

[5]

3

- (a) any **two** from: eg
- same volume of solution
*do **not** allow same size of container*
 - left for same length of time
 - same temperature
 - same oxygen
 - same pH
 - same number of invertebrates / animals
*do **not** allow same number of species*
 - same age / stage of invertebrates / animals
- 2
- (b) line of best fit / curve / point to point drawn going through 240-260 and 25
 1
- correct interpolation to X axis
if no work on graph allow 250
 1
- (c) (i) (C)
 50% killed at lowest / low copper concentration
ignore least survivors
 1

- (ii) any **two** from:
- involves counting
easy to count gains 2 marks
 - easy to do
 - invertebrates more sensitive
 - needs less / no apparatus
ignore more reliable / accurate

2

[7]

4

- (a) (i) producer
all three for 2 marks
- consumer
allow 1 mark for two correct
- consumer
ignore qualifications to 'consumer'

2

- (ii) five blocks in second row
ignore any labelling

1

nineteen blocks in third row

1

each row centred correctly
independent mark

1

- (iii) respiration
ignore aerobic / anaerobic

1

- (b) (i) 100 gains 2 marks

$$\frac{60 \times 30}{18} = 1 \text{ mark}$$

1800

or

their 1800 / 18 correctly calculated gains 1 mark

2

- (ii) any **one** from:
 visibility of snails
 toxicity
ignore harmful

1

[9]

5

- (a) (i) (predator) lion

1

(prey) antelope

1

- (ii) light
accept other positive indications

1

- (iii) in sequence (top to bottom):

lion
 antelope
 grass

1

- (b) (i) bacteria / fungi / saprotrophs
*accept moulds / decomposers / microorganisms / microbes /
 saprophytes / saprobionts*

1

- (ii) aerobic

1

moist

1

warm

accept other positive indications 1

1

- (iii) carbon dioxide

1

mineral salts

1

[10]

6

- (a) (i) three or four points plotted correctly
allow $\pm \frac{1}{2}$ square

1 or 2 points plotted correctly gains 1 mark

2

curve of best fit

1

(ii) decrease in methane production

1

after 2003 the rate of decline has decreased **or** the line is not as steep **or** rate of decrease is slowing

accept after 2005 / 2007

1

(b) Kyoto Protocol

1

[6]

7

(a) drawn correctly

1

labelled correctly

1

must have 4 steps, decreasing as go up
actual lengths not necessary

(b) (i) 12600 (kJ/m³)

1

(ii) lost as heat **or** in movement **or** in faeces **or** excretion
or by respiration

1

[4]

8

(a) leaching

accept run-off

1

oxygen

1

eutrophication

1

(b) collect samples from stream at various points

1

identify the organisms on the chart in each sample

1

identify the least tolerant organism in the sample

1

use the chart to find the highest level of pollution that the least tolerant organism can survive

1

[7]

9

- (a) the sun / light / sunshine / solar
allow radiation from the sun
ignore photosynthesis / respiration
apply list principle
*do **not** allow water / minerals / heat*

1

- (b) 2.5 (:1)

correct answer with or without working

ignore rounding with correct working

*do **not** allow other equivalent ratios for both marks*

*evidence of selection of 10(insects) **and** 4(frogs) **or** 50 **and** 20 **or** 1 **and** 0.4 for 1 mark*

if no other working allow 1 mark for 0.4:(1) on answer line

2

- (c) any **two** from:

*allow for insects **or** frogs*

allow energy for biomass

- some parts indigestible / faeces
- waste / examples of waste eg urea / nitrogenous compounds / urine / excretion
- movement / eg of movement
allow keeping warm
- heat
- not all eaten / eg of not all eaten
- respiration

do not accept energy for respiration

2

(d) any **four** from:

- (bodies) consumed by animals / named / scavengers / detritus feeders
- microorganisms / bacteria / fungi / decomposers
- reference to enzymes
- decay / breakdown / decompose / rot
ignore digest(ion)
- respiration
- carbon dioxide produced
- photosynthesis
- sugar / glucose produced
accept other organic molecules
- fossilisation / fossil fuels / named
- combustion / burning
must be linked with fossilisation / fossil fuels
- (burning) produces carbon dioxide
allow carbon dioxide produced once only

4

[9]

10

(a) (i) respiration

apply list principle

1

(ii) combustion / burning

apply list principle

1

(iii) decomposers

accept bacteria / fungi / microbes / microorganisms / mould /

detritivores eg worms

ignore insects

1

(b) warm

*do **not** allow hot*

ignore heat

1

moist / damp

ignore wet

1

aerobic / aerated

accept (plenty of) oxygen / air

ignore any explanations

ignore light / dark

1

(c) any **three** from:

- no information on levels before 1950
- (60 years) is not long enough to monitor changes
- the scale on the y axis makes the level appear to change considerably more
- the graph shows data from only one location on the planet
- there is nothing to show temperature rise matches / follows rise in CO₂
- not valid because Hawaii has volcanoes which produce CO₂

3

[9]

11

(a) (i) carbohydrate*/fat/protein in cell
(or example e.g. glucose/starch)

for 1 mark

1

(ii) $\frac{21500}{1050000} \times 100$ or 2.(05)%

for 1 mark

1

(b) *ideas that:*
little energy used for growth/most wasted/lost

gains 1 mark

but

only 4% used for new growth

gains 2 marks

evidence/idea that this is repeated at each stage
idea of diminishing return/less energy at each stage

for 1 mark each

(maximum of 3)

3

- (c) *idea:*
 plants at the start of all food chains
 shorter food chain
 more efficient/less energy lost/more food
 cheaper/more economic
 (must bear consequence of at least one of earlier marks)
any three for 1 mark each

3

[8]

12

- (a) (i) (tiny green) plants / phytoplankton
for 1 mark

1

(ii)

- penguin
 - shrimp
 - cod
 - squid
- any two for 1 mark*

1

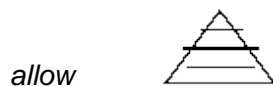
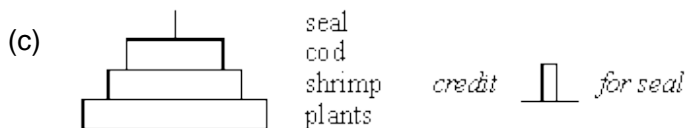
- (b) Decrease: seals will eat more squid and penguins
for 1 mark

1

Stay the same:

- more shrimp for squid and penguins
 - squid and penguins increase balances the extra eaten by seals
 - seals find other prey [allow shrimps]
- any two for 1 mark each*

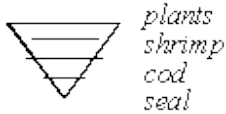
2



- correct / shape (designs need to be to scale)
- correctly labelled with organisms

(if wholly correct but inverted then credit 1 mark)

each for 1 mark



2

[7]

13

(a) (i) any **one** from:

- carbon dioxide
accept water vapour
- nitrous oxide
*do **not** accept methane*
allow carbon monoxide

1

(ii) methane

accept nitrous oxide if not given in 7(a)(i)
allow carbon dioxide if not given in 7(a)(i)

1

(iii) Kyoto (agreement)

1

(b) (i) there is a greater increase with fertiliser / between Test 1 and Test 2 / 3

or

number of (duckweed) leaves increase more with more fertiliser added
allow the number of leaves increase for 1 mark

2

(ii) any **four** from:

- (cause the) algae / plants to grow (rapidly) on the surface
- this prevents sunlight reaching the plants (underneath)
- the plants die and bacteria break down the plants
- (bacteria) uses up the oxygen (in the pond)
- so fish die
ignore plants / animals
do not allow 'kills all living things'
if no other marks awarded, eutrophication gains 1 mark

Max 4

[9]

- 14** (a) (i) combustion of fuels eg transport **or** power generation **or** industrial activity
allow 'respiration'
ignore breathing 1
- (ii) any **one** from:
 - farming rice
 - landfill
 - (farming) cattle
 - sewage treatment 1
- (iii) any **one** from:
 - transport
eg driving cars but cars alone is insufficient
 - using fertilisers
 - power generation
*do **not** accept nuclear power*
ignore factories / industry 1
- (b) (increase in gases) absorbs more (long-wave) radiation from the Earth
allow prevents re-radiation 1
- (which) keeps heat in the atmosphere 1

[5]

- 15** (a) collect samples from stream at various points 1
- identify the organisms on the chart in each sample 1
- identify the least tolerant organism in the sample 1
- use the chart to find the highest level of pollution that the least tolerant organism can survive 1
- (b) 3–4 1

(c) fertiliser causes rapid growth of plants / algae
allow overcrowding

1

lack of light for photosynthesis

1

plants / algae die and are decomposed (by bacteria)

1

bacteria respire rapidly and remove oxygen from the water

1

[9]

16

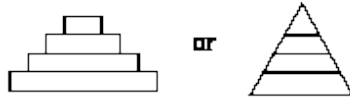
(a) 0.1

ignore working or lack of working

$$\frac{88 \times 100}{88\,000} \text{ for 1 mark}$$

2

(b) shape: pyramid with 4 tiers



1

labels:

Plants + Herbivores + Carnivores + Top
carnivores

(in sequence – largest to smallest)

allow suitable named examples

inverted pyramid correctly labelled = 1 mark

1

(c) more energy / biomass / materials / matter
available or less energy lost or energy used up (by herbivores)

not just plants

1

[5]

17

(a) **correct calculation of scale:**
correctly labelled diagram for 4 marks

plants $800 \div 16 = 50$

herbivores $160 \div 16 = 10$

carnivores $64 \div 16 = 4$

top carnivores $16 \div 16 = 1$

max 2

four correct for 2 marks

three correct for 1 mark

accurate plotting of pyramid

1

allow ecf from calculations

allow error $\pm \frac{1}{2}$ square

diagram must look like pyramid drawn on a central axis

correct labelling

1

(b) **one** from:

- energy lost to the environment between each trophic level
owtte
- not all biomass is digestible **or** some lost in faeces / excretion
accept biomass that is not eaten and moves to decomposers
- energy lost due to movement

1

[5]

18

(a) $(200/1000) \times 100$ or $1000 - (750 + 50)$
correct answer with or without

1

= 20%

working gains 2 marks

1

(b) any **three** from:

- correct reference to respiration
eg some of the energy is lost as a result of respiration
- some of the energy is used to maintain body temperature **or** lost as heat
- some of the energy is used in movement
- some of the energy is lost in excretion **or** in waste products
ignore lost as waste

3

(c) pyramid in correct order, with correct labels

1

each box to scale

1

sensible scale and reasonable use of graph paper

best scales:

4 = 1 small square

8 = 1 small square

1

[8]

19

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content

Level 1 (1–2 marks)

At least one greenhouse gas is identified

or

a way they are produced is identified

Level 2 (3–4 marks)

at least one greenhouse gas is identified

and

is linked to a way it is produced

Level 3 (5–6 marks)

Greenhouse gases are identified

and

are correctly linked to descriptions of the ways the gases are produced

examples of the points made in the response

extra information

- carbon dioxide
 - allow*
 - released from power stations
 - released from cars / vehicles
 - released from domestic sources e.g fires
 - released from trees that have been cut down (through deforestation)
 - produced by (humans) burning fossil fuels
 - released from trees that have been cut down (through deforestation)
 - produced through decay / decomposition (of trees)
 - *water vapour*
 - *released from power stations*
 - *released from cars / vehicles*
 - *produced by (humans) burning fossil fuels*
 - ignore reduced photosynthesis due to deforestation*
- methane
 - released from landfill
 - released from rice fields / farming / cattle / faeces
 - released from trees that have been cut down (through deforestation)
 - through decomposition or microbial action
- nitrous oxide
 - released from vehicles

- released from power stations
 - produced by (humans) burning fossil fuels
 - released through farming
 - through the increased use of nitrogen based fertilisers
- ignore respiration of humans / animals*
ignore references to the consequences of greenhouse gas emissions e.g. global warming

[6]

20

(a) energy enters as light

1

when plants photosynthesise

1

(b) energy leaves as heat

1

as a result of respiration

OR

energy leaves as chemical energy (1)

in waste / faeces / as excretion / on death (1)

1

(c) Any **two** from

- energy is lost (as heat) at each stage of the food chain
- biomass is lost (in waste) at each stage of the food chain
- idea that amount of energy / biomass in food chain gets too small to pass on.

2

[6]

21

(a) water

gains 1 mark

oxygen

gains 1 mark

2

(b) e.g.:

some materials/energy lost in animals' waste materials

respiration releases energy

some materials/energy used in maintenance/repair

some energy used for movement

much lost as heat to surroundings

some organisms die (rather than eaten)

reference to detritivores

reference to microbes

each for 1 mark

8

[10]

22

(a) $1.67 / 1 \frac{2}{3}$

accept 1.6 to 1.7

ignore working or lack of working $\frac{400 \times 100}{24000}$ for 1 mark

2

(b) any **three** from:

deduct only 1 mark for any mention of in carnivore

lost as heat **or** keeping body warm

lost in metabolic functions is not enough

lost in respiration

*do **not** accept 'used for respiration'*

movement

not eaten parts or individuals / non-edible parts / dead leaves / wood / bones / faeces / urine

ignore 'waste'

ignore references to growth / reproduction

3

[5]

23

(a) pyramid correct shape labelled

2

(b) warm
moist
oxygen

3

[5]

24

(a) (i) vole/small bird/beetle
gains 1 mark

1

(ii) oak trees are large organisms;
therefore their biomass is large; but their numbers are small
each for 1 mark

3

- (b) 8 of:
 energy stored in chemicals in cells/tissues/growth;
 passed up food chain;
 less energy stored at each stage in food chain/pyramid level;
 because only part of energy taken in used for growth;
 some lost in waste;
 some used for repair;
 used to main body systems;
 some lost in respiration;
 some converted into other forms of energy;
 e.g. movement;
 much lost as heat;
 by time detritus feeders have used remains;
 all returned to environment

each for 1 mark

8

c1 → animals

c2 → decomposers

2 marks for sequencing and organising the information

2

[14]

25

- (a) any **one** from:

- bloodworm
- water louse
- sludgeworm
- rat-tailed maggot

1

- (b) (i) look for as many different lichens on trees as possible

1

identify the lichens

1

find the least tolerant lichen in the forest

1

use the chart to find the level of pollution

1

- (ii) Bryoria only found at Site **A** or no Bryoria at Site **B**

1

Site **B** polluted by chemicals blown in wind (from factory)

1

- (c) (i) (carbon dioxide from) increased use of fossil fuels

1

(methane from) decomposing rubbish in landfill / cultivating rice / cattle farming

1

(nitrous oxide from) (increased) use of fertilisers / from vehicle exhausts
allow any suitable named example

1

- (ii) (greenhouse gases) absorb more long-wave radiation

1

heat is retained

*accept (greenhouse gases) allow more short-wave IR from the sun
to pass to Earth's surface but absorb long-wave IR from surface of
the Earth for 2 marks*

1

[12]

26

- (a) (i) 24 gains 3 marks

any fraction of a snail given e.g. 24.04 max 2

61 x 41 or 2501 for 1 mark

$\frac{61 \times 41}{104}$ or $\frac{2501}{104}$ for 2 marks

their $\frac{2501}{104}$ correctly calculated

and rounded down to whole number for 2 marks

3

- (ii) weigh the five snails

1

calculate an average mass

1

multiply by population size / 104

1

- (b) (i) first row one square

all 3 correct for 2 marks

2

second row seven squares

1 or 2 correct for 1 mark

third row twenty three squares

pyramid the correct way up **and** centred **and** labelled

centred with each other

1

- (ii) recognition that the bird would need 1000 grams of snails

*to gain full marks there must be some use of number to justify the
answer*

1

but as there are only 700 grams it must be eating something else

1

recognition that the snails would need 7000 grams of cabbage

1

but as there are only 2300 grams they must be eating something else

*if no other marks allow 1 for the suggestion that there are not
enough snails for the bird **or** there are not enough cabbages for the
snails*

1

[13]