# **ORGANISATION OF AN ECOSYSTEM PART III**

# Q1.

	One	e food chain in the wood is:
		Hazel tree nuts $\rightarrow$ squirrels $\rightarrow$ owls
	(i)	What does this food chain tell us?
(	(ii)	Which <b>one</b> of the organisms in the food chain is a producer?
	(iii)	This year the hazel bushes have produced very few nuts.
		Explain, as fully as you can, how this might affect the populations of:
		1. squirrels;
		2. owls.

(b) An area of the floor of the wood 1 m<sup>2</sup> was fenced off so that animals could not reach it. The graph below shows the depth of leaf litter (dead leaves) inside the fence over the next few months. (4)



Explain, as fully as you can,

(i) why the depth of the leaf litter decreased;

(ii) how this decrease happened.

(iii) In which month does leaf litter disappear fastest? Explain why.

(2) (Total 11 marks)

(1)

(1)

# Q2.

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.

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

(3)



# Q3.

This is a diagram of a belt transect showing the major types of plants growing on the bottom of a lake.



(a) Suggest, and explain, **two** reasons why a much smaller population of Nitella plants is found amongst the Potamogeton plants than further down in the lake.



(b) Describe how you would use the belt transect technique to measure the abundance and distribution of plants which live on the bottom of a shallow lake.



#### Q4.

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.



(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.



# Q5.

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



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

(ii) The algae are small green plants.

Give three conditions needed by green plants to produce sugars.

1. \_\_\_\_\_

(1)



(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)

(2)

(3)

### Q6.

The diagram below shows the mass of carbon involved each year in some of the processes in the carbon cycle.



(a) Complete the equation for plant respiration.



(b) (i) Calculate the mass of carbon removed from the atmosphere each year. (Show your working.)

(ii) Calculate the percentage of this total which is removed by the photosynthesis of land plants. (*Show your working*.)

Answer \_\_\_\_\_\_%

(iii) Calculate the net gain of carbon by the atmosphere in one year. *(Show your working.)* 

Answer \_\_\_\_\_\_ billion tonnes

(2) (Total 7 marks)

# Q7.

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.

(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)

(2)

(1)

(2)

Q8.

The drawing shows a section through a well-designed compost heap.



(a) Suggest why soil is put in with the dead plant material.

(b) Explain why the compost heap is designed with holes in the sides.

(2) (Total 4 marks)

(2)

# Q9.

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

(2)

The results were:

Energy in sugar produced by trees       44 000 kJ per m² per year         Energy transferred to primary consumers       2 920 kJ per m² per year         Energy transferred to secondary consumers       700 kJ per m² per year         (i)       Calculate the percentage of the energy absorbed by the trees that is transferred to sugar by photosynthesis. Show your working.         Answer       %         (ii)       Suggest two reasons why a large proportion of the energy is not transferred to sugar.         1.	
<ul> <li>Energy transferred to primary consumers 2 920 kJ per m<sup>2</sup> per year</li> <li>Energy transferred to secondary consumers 700 kJ per m<sup>2</sup> per year</li> <li>(i) Calculate the percentage of the energy absorbed by the trees that is transferred to sugar by photosynthesis. Show your working.</li> <li>Answer %</li> <li>(ii) Suggest two reasons why a large proportion of the energy is not transferred to sugar.</li> <li>1</li> <li>2</li> <li>(iii) Give three reasons why some of the energy in the primary consumers is no passed on to the secondary consumers.</li> <li>1</li> </ul>	
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<ul> <li>2</li></ul>	_
<ul> <li>(iii) Give <b>three</b> reasons why some of the energy in the primary consumers is no passed on to the secondary consumers.</li> <li>1</li></ul>	_
<ul> <li>(iii) Give <b>three</b> reasons why some of the energy in the primary consumers is no passed on to the secondary consumers.</li> <li>1</li></ul>	
	t
2	
Z	_
3	
	_

# Q10.

The table shows the results of a ten-year study of the owls and voles in a forest.

YEAR	NUMBER OF VOLES (TO THE NEAREST THOUSAND)	NUMBER OF OWLS
1	15 000	8
2	12 000	9
3	15 000	7
4	23 000	9
5	40 000	14
б	2 000	28
7	9 000	8
8	19 000	9
9	10 000	14
10	8 000	16

The data for years 1 - 7 have been plotted on the grid below.



(a) Complete the graph by plotting the data for years 8 - 10.

(b) (i) What is the main factor which limits the size of the owl population?



(2)

# Q11.

The diagram shows some of the stages by which materials are cycled in living organisms.



- (a) In which of the stages, **A**, **B**, **C** or **D**:
  - (i) are substances broken down by microbes;
  - (ii) is carbon dioxide made into sugar;
  - (iii) are plants eaten by animals?
- (b) In an experiment, samples of soil were put into four beakers. A dead leaf was put onto the soil in each beaker. The soil was kept in the conditions shown.



In which beaker, W, X, Y or Z, would the dead leaf decay quickest?

(1) (Total 4 marks)

# Q12.

Read the passage.

(3)



# Glutton up a gum tree

Along the banks of the Cygnet River on Kangaroo Island, the branches of the dying gum trees stretch out like accusing fingers. They have no leaves. Birds search in vain for nectar-bearing flowers.

The scene, repeated mile upon mile, is an ecological nightmare. But, for once, the culprit is not human. Instead, it is one of the most appealing mammals on the planet – the koala. If the trees are to survive and provide a food source for the wildlife such as koalas that depend on them, more than 2000 koalas must die. If they are not removed the island's entire koala population will vanish.

Illegal killing has already started. Worried about soil erosion on the island, some farmers have gone for their guns. Why not catch 2000 koalas and take them to the mainland? "Almost impossible," says farmer Andrew Kelly. "Four rangers tried to catch some and in two days they got just six, and these fought, bit and scratched like fury."

Use the information from the passage and your own knowledge and understanding to give the arguments for and against killing koalas to reduce the koala population on Kangaroo Island.



(Total 4 marks)

#### Q13.

Read the passage.



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The diagram shows the flow of energy through a koala. The numbers show units of energy.



(i) Calculate the percentage of the food intake which is converted into new tissues for growth. Show your working.

%

(2)

# (ii) Give **three** different ways in which the koala uses the energy released in respiration.

1	 	 	 
2	 		 
3			 

(Total 5 marks)

(3)

Compost heaps are used to recycle waste plant materials.



Complete the sentences by choosing the correct words from the box.

cool	deca	ay o	dry	grow
	maiat	****		
	moist	respire	warm	
The wast	e plant materials _		because they	are broken
microorga	nisms.			
The wast	e plant materials a	e broken down fa	aster when the	conditions
are	and			

This process releases substances that can be used by other plants to \_\_\_\_\_

(Total 4 marks)

# Q15.

Greenfly feed on rose bushes. Ladybirds (predators) feed on these greenfly. The graph shows how the population of greenfly and ladybirds in a garden change over a period of three years.



(a) To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

Describe what happened to the population of greenfly over the three years.

Give <b>one</b> factor that limits the number of ladybirds.	
	(Total 4 mar

# Q16.

In a sewage works, human waste is broken down by microorganisms. Air is blown through this sewage.



To gain full marks in this question you should write your ideas in good English. Put them into a sensible order and use the correct scientific words.

Carbon dioxide is formed from the mixture of sewage, microorganisms and air. Explain how.

# Q17.

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

 $\textbf{A} \ \rightarrow \ \textbf{B} \ \rightarrow \ \textbf{C} \ \rightarrow \ \textbf{D}$ 

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

Organism	Energy transferred in kJ per year
Α	87 000
В	14 000
С	1600
D	70

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

(Total 5 marks)

# Q18.

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

Organisms in food chain							
	Rose plant	$\rightarrow$	Greenfly	$\rightarrow$	Ladybird	$\rightarrow$	Blackbird
Biomass in g/m <sup>2</sup>							
	600		50		10		1

(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<sup>2</sup>.)



Biomass in g/m<sup>2</sup>

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

Proportion = \_\_\_\_\_ (2) (Total 5 marks)

(3)

# Q19.

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.

Energy "lost" = \_\_\_\_\_ kJ

(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)

# Q20.

The graphs give information, from a hundred years ago, about the size of the population of snowshoe hares and lynx, which live in northern Canada. Snowshoe hares are herbivores. Lynx are carnivores and prey on snowshoe hares.

(1)



(a) Give **three** factors which can affect the size of the snowshoe hare population.



(b) The graph for numbers of lynx shows a similar cycle to that of the snowshoe hares. The peaks for lynx usually occur about a year later than the peaks for the snowshoe hares. Suggest why.

> (2) (Total 5 marks)

#### Q21.

(a) The diagram shows a cereal crop.

Complete spaces (i) and (ii).

(3)



- (iii) What sort of weather may cause the cereal crop to wilt?
- (b) Describe the process of transpiration in plants.

(3) (Total 6 marks)

(2)

(1)

# Q22.

(a) Use words from the box to complete the sentences about the water cycle.

	boils condenses		eva	porates	freezes	5		
	m	elts	rain	sea	Sun	wind		
Wate	r	1	from the s	surface o	of the		Hea	t from the
speeds up this process and so does the								
Water vapour in the atmosphere cools down and to form billions of								
tiny water droplets. Some of the droplets join together and fall as								

(b) The diagram shows some processes in the carbon cycle.



(i) What is the name of substance X?

(1)

(ii) Which process, **A**, **B**, **C**, **D** or **E**, takes the **longest** and approximately how long does it take?

(2) (Total 9 marks)

# Q23.

A food chain in the North Atlantic Ocean is:

#### diatoms $\rightarrow$ small fish $\rightarrow$ large fish

The graphs show how over a year:

- the population size of diatoms in the North Atlantic varies;
- the light intensity alters;
- the concentration of nitrate and phosphate minerals alters.

Concentration of nitrates and phosphates	
Diatom population size	Light intensity

(a) Explain why the light intensity is a major factor in controlling the numbers of diatoms.

(2) (b) Suggest two reasons why the population of diatoms decreases between (i) spring and summer. 1.\_\_\_\_\_ 2. \_\_\_\_\_ (2) (ii) Give two reasons why the population of diatoms decreases in autumn. 1. \_\_\_\_\_ 2.\_\_\_\_\_ (2) (c) Use the information on the graph to suggest what change causes the number of diatoms to increase in the late summer. Give a reason for the change.

# Q24.

(a)	A gardener was told to let more air into his heap of garden waste.	
	Explain why this would help decay.	
		-
		- (1)
(b)	Write down <b>two</b> further conditions which speed up the decay of garden waste in a compost heap.	(-)
	1	-
	2	-
	(Total 3	(2) marks)

# Q25.

The greenfly is an insect which is eaten by ladybirds.



(a) (i) What do we call animals, like the ladybird, which hunt and kill other animals for food?

(1)

(ii) What do we call animals, like the greenfly, which are eaten by other animals?

(1)

(1)

(b) What would happen to the number of ladybirds if the numbers of greenfly suddenly dropped?

Give a reason for your answer.

- (c) Suggest **two** factors, other than the number of ladybirds, which could affect the number of greenfly.
  - 1.\_\_\_\_\_ 2.\_\_\_\_\_(2)

(Total 6 marks)

#### Q26.

Mushrooms can be grown on compost. The compost is made by mixing straw and manure which rot down.



- (a) Write down **three** things which are needed for the straw and manure to rot.
- (b) Some substances, like plastic, are not biodegradable.

What does this mean?

(1) (Total 4 marks)

# Q27.

In some developing countries woodland is cut down and burned. The ash acts as fertiliser. Crops are grown for three years. The land is then left as it is too poor to grow any more crops.



(a) In the original woodland trees and plants died and grew for hundreds of years. When cleared the land grew crops for only three years. Explain this difference in as much detail as you can.

- (b) What could farmers do to make crops grow on the cleared land for more than three years?
  - (2) (Total 5 marks)

(3)

# Q28.

(a) 1m<sup>2</sup> 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?



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.

(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)

Q29.



A farmer had too much manure to spread on his fields. He thought he would turn it into compost which had no smell.

(a) What makes the manure decay?

(3)

- (b) Write down **two** conditions which will help the manure to decay faster.
  - 1. \_\_\_\_\_\_ 2. \_\_\_\_\_\_ (2)

(Total 3 marks)

# Q30.



The diagram shows how the gas from decaying plant and animal waste can be collected.

(a) (i) Name the gas collected from the decaying waste.



(1) (Total 3 marks)

# Q31.

Some small mites feed on the leaves of orange plants. Larger mites feed on the smaller mites.

(a) What do we call animals, like the large mite, which eat other animals, like the small mite?

(1)



The graph shows how the number of these mites changes over a period of time.

(b) (i) What happens to the number of large mites one week after the number of small mites decreases?

What hap mites incr	pens to the number of small mites as the number of large eases?	
Suggest a	a reason for this.	

(2) (Total 6 marks)

(1)

# Q32.

Earthworms are important soil organisms. When they burrow, they help to bring air into the soil as well as improving drainage. Earthworms also bury leaves in the soil. These decay making the soil more fertile. Earthworms in turn are eaten by voles, moles, foxes, badgers and birds.



New Zealand flatworm

In some parts of the United Kingdom, earthworms are being killed by New Zealand flatworms. The animals are spreading quickly and have no natural enemies.

The flatworms do not make their own burrows. They only use the burrows made by the earthworms in order to attack them.

(a) Explain, as fully as you can, why it is important to control or get rid of these New Zealand flatworms in Britain.

(b) Suggest one possible way, giving one advantage and one disadvantage, that this New Zealand flatworm could be controlled. (4)

# Q33.

Food decays more slowly if it is kept dry or cool.



#### Explain why.

(Total 3 marks)

#### Q34.

Whitefly are pests and harm plants in glasshouses. A small wasp can be used to control the whitefly.



The wasp can only lay its eggs in the larvae of whiteflies. The wasp larva eats the body of the whitefly larva. It then changes into a new wasp and flies off.

(a) Choose words from the list to complete the sentences below.

	decomposer	predator	prey	producer
The wasp	o larva feeds on the v	vhitefly larva.		
The wasp	o is a			
The white	efly is known as the w	vasp's		

(b) The graph shows how the numbers of whitefly and wasps change over several months.



What happens to the number of wasps between 15 and 20 months?

Why do you think this happens? \_\_\_\_\_

(c) What would happen to the wasps if there were no larvae in which to lay their eggs?

(1) (Total 7 marks)

(4)

# Q35.

The elephant is likely to become extinct in parts of Africa.

Use the information below to explain three reasons why.



- \* The African elephant eats lots of trees and other plants for food.
- \* In Africa the human population is increasing and more food is needed to feed the extra people.
- \* More trees are cut down for fuel and to clear land for growing crops.
- \* Elephants are killed by poachers who want the ivory from their tusks.
- \* A herd of elephants needs a large area in which to live and feed.

1	
2	
3	
	(Total 3 marks)

# Q36.

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

	tiny green plants shrimp cod seal (phytoplankton) squid
(i)	Write down the name of the producer in this web.
(ii)	Write down the names of <b>two</b> organisms which are prey in this web.
Hur	nans are removing large numbers of the cod.
<u> </u>	
and Oth	penguins. pers argue that this could lead to a decrease in the numbers of squid pers argue that the numbers of squid and penguins will stay the same.
and Oth Ca	refully explain each argument.
and Oth Ca Wh	The scientists argue that this could lead to a decrease in the numbers of squid penguins. Ters argue that the numbers of squid and penguins will stay the same. Tefully explain each argument. They might decrease.
and Oth Ca Wr	The scientists argue that this could lead to a decrease in the numbers of squid penguins. The penguins is argue that the numbers of squid and penguins will stay the same. The refully explain each argument. The y they might decrease.
and Oth Ca Wr  Wr	<pre>ne scientists argue that this could lead to a decrease in the numbers of squid penguins. ers argue that the numbers of squid and penguins will stay the same. refully explain each argument. y they might decrease.</pre>

chains in the web.



Draw and label a pyramid of biomass for this chain.

(2) (Total 7 marks)

# Q37.

The diagram shows part of the carbon cycle.



(a) Write down the name given to process A.

(1)

(b) Explain, as fully as you can, how some of the carbon in the grass becomes part of the fox's body.

#### Q38.

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.

Why they might stay the same.

(2)

(1)

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

tiny green plants	 shrimp	 cođ		seal
1000 tonnes	100 tonnes	10 tonnes	(	0.5 tonne

Draw and label a pyramid of biomass for this chain.

(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.

- (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,
  - (ii) Suggest why one of your control measures would be difficult to put into practice.
    - (1) (Total 11 marks)

#### Q39.

When animals die, bacteria make them decay. Warmth, moisture and oxygen are needed for this to happen.

In northern Russia whole bodies of mammoths have been found in the frozen (a) (i) soils.

Explain why they did not decay.

(2)

(3)

(2)



(ii) Fish fossils have been found in mudstone rock. Explain why they did not decay?



(b) Some of the mammoths had flint weapons in their bodies.

Suggest **two** things that this tells us about human evolution.

1.\_\_\_\_\_ 2.\_\_\_\_\_ (2) Mammoths are now extinct. Suggest two reasons for this. (c) 1.\_\_\_\_\_ 2.\_\_\_\_\_

# Q40.

In compost heaps, dead plants are broken down by microbes. This breakdown is much slower:

(2)

(2)

(Total 7 marks)

- when the weather is cold
- when the weather is dry
- when the heap is squashed down so that no air can circulate.
- (a) What **three** conditions inside compost heaps are needed for microbes to work **quickly**?



# Q41.

Copepods are tiny animals which live in the sea.



During the day they live deep down near the sea bed. At night they move up to the surface where they feed on tiny plants. When the sun rises they move down to the bottom again.

(a) Suggest why the tiny **plants** live near the surface of the sea.

(Total 4 marks)

(b) Herring feed on copepods.

Where will herring be found during the day? Give a reason for your answer.

(1)

#### Q42.

Brown trout are fish that kill and eat other animals.

(a) Choose a word from this list to complete the sentence below.

competitors	consumers	prey	producers
oomponioio	Consumers		producero

Trout are predators, the animals they eat are their \_\_\_\_\_\_.

(b) The graph shows the ages of the brown trout found in the river Tees.

There was no serious pollution in the river during this time.



Suggest three reasons why few brown trout live to be over two years old.



(3) (Total 4 marks)