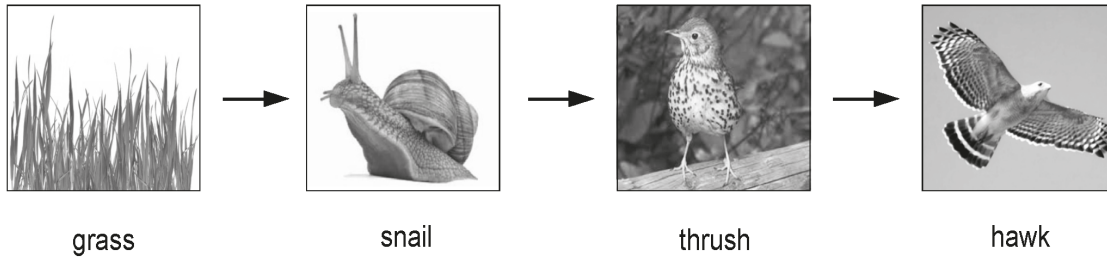


WJEC (Wales) Biology GCSE
Topic 1.6 Ecosystems,
Nutrient Cycles and Human
Impact on the Environment
Questions by Topic

1.

The photographs below show a food chain.



(a) State the source of the energy used by the grass. [1]

.....

(b) Complete the following sentence:

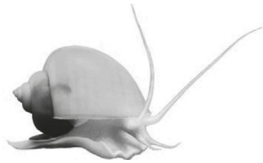
Arrows in the food chain show the flow of [1]

(c) The table below shows how much energy enters each organism in the food chain in one day.

organism in food chain	energy entering each organism (kJ)	percentage energy in grass passed on (%)
grass	2500	
snail	500
thrush	25	1
hawk	0.5	0.02

(i) Use data in the table to calculate the percentage of the energy **entering the grass** that is passed on to the **snail**. Show your working below and write your answer in the table. [2]

2. Some organisms living in a large lake and their total biomass in kg are shown below.
They are **not** drawn to scale.



Snails
4 500 kg



Pike
250 kg



Aquatic plants
45 000 kg



Minnows
500 kg



Beetles
800 kg

- (a) (i) Which of the organisms above are likely to be present in the least numbers? [1]

.....

- (ii) The organisms above all form part of the same food chain.
In the space below, draw a **labelled** diagram to show a pyramid of biomass containing **all** of these organisms. [2]

- (iii) The pike in the lake are affected by a parasite, called a fish louse, which lives on their skin. There would be many of these parasites on each pike but their biomass would be less than the biomass of the pike.

How would you add this information to the pyramid you drew in (a)(ii)?

Tick (✓) the correct answer.

[1]

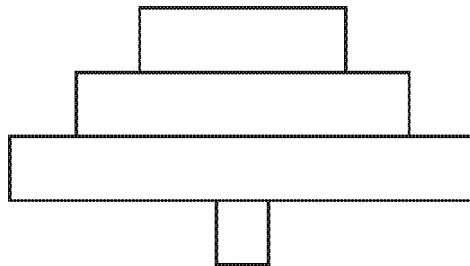
Place them at the tier above the pike

Place them at the bottom of the pyramid

Place them below the minnows

Place them in the tier below the pike

- (b) Explain how a pyramid of **numbers**, for some organisms living on land, could look like the one shown below: [2]



.....

.....

.....

6

3.

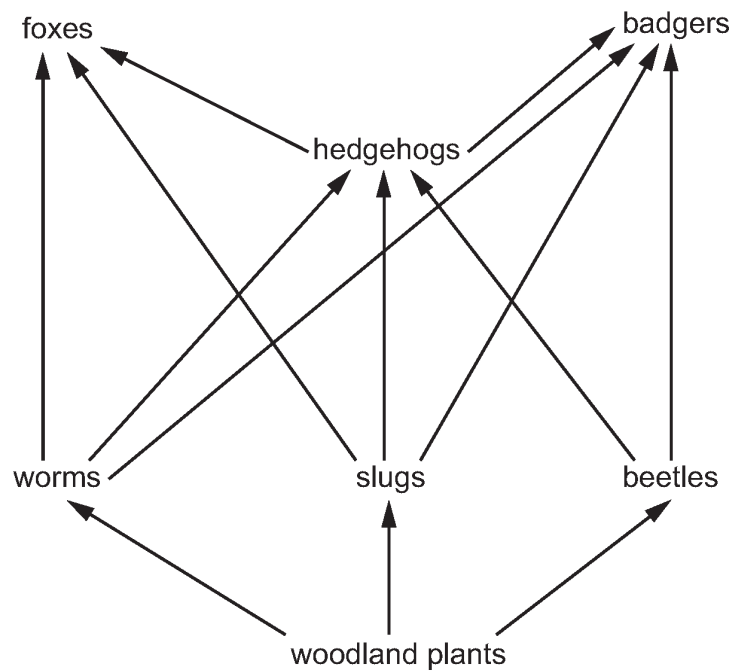
The photograph shows a hedgehog.



(a) Hedgehogs are carnivores. What does the term *carnivore* mean?

[1]

(b) The diagram below shows a woodland food web that includes hedgehogs.



Use information in the food web opposite and your own knowledge to answer the following question.

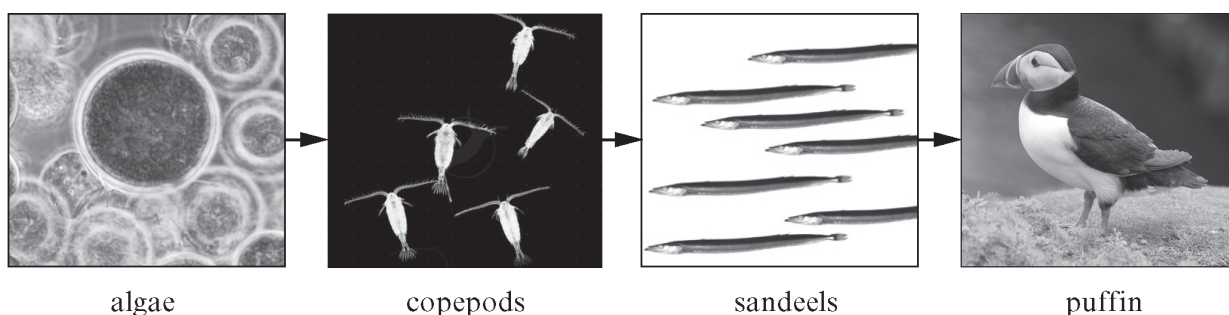
In recent years, the number of hedgehogs in the UK has decreased. Tick (✓) the three factors in the following table that could cause hedgehog numbers to decrease. [3]

factor	causes hedgehog numbers to decrease
a disease harming the badgers	
an increase in the number of foxes	
the arrival of a new second stage consumer species	
an increase in the number of beetles	
a decrease in the area of woodland	

4

4.

The diagram below shows a food chain from the North Sea.



From the information in the food chain above:

- (a) State the herbivore. [1]
- (b) State the second stage consumer. [1]
- (c) In recent years, the number of copepods has decreased. There has also been a decrease in the number of puffins.
Suggest an explanation for the decrease in the number of puffins. [2]

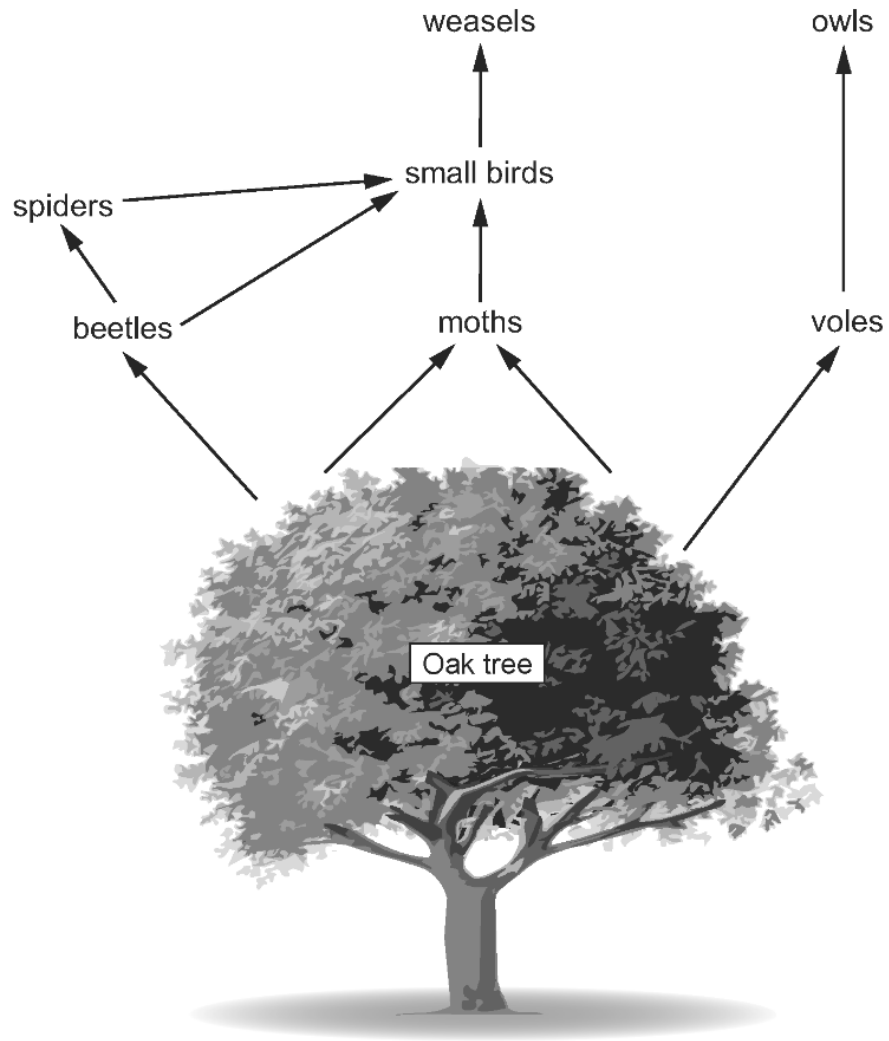
.....

.....

4

5.

The diagram below shows a food web.



(a) (i) State the source of energy for the food web. [1]

.....

(ii) State **one** way in which energy can be lost from the food web. [1]

.....

(b) Circle *true* or *false* in the table for each of the following statements about this food web. [3]

Statement			
1	Moths and voles are first stage consumers.	true	false
2	Owls are third stage consumers.	true	false
3	Small birds are both third stage and second stage consumers.	true	false
4	Weasels and spiders are second stage consumers.	true	false
5	The oak tree is the only producer.	true	false

(c) (i) Complete the flow diagram below to show **one food chain** from the food web. [1]



(ii) Draw a pyramid of biomass to represent this food chain, in the space below.

Label each level in the pyramid with the name of the organism.

[2]

8

6.

The table shows information about some of the organisms present in a grassland food web and the flow of energy through the food web.

type of organism	name of organism	number of organisms	mass of organisms (kg)	energy flow through the food web (kJ)
producer	grass	300 000	350.00	20 000
primary consumers	grasshoppers	25 600	5.12	1 353
	seed-eating birds	45	1.08	2 567
	field mouse	42	1.05	1 941
secondary consumer	kestrel (bird of prey)	2	0.34	412

- (a) (i) Calculate to two decimal places the percentage of energy which passes from the producer to the primary consumers. Show your working. [2]

percentage of energy = %

- (ii) State **two** ways in which energy can be lost from the food chain. [2]

.....
.....

- (b) Select a single food chain **from the table** opposite and draw a **fully labelled** pyramid of biomass to represent it. [2]

7.

Concerns over the effects that the insecticide DDT was having on top predators in the 1960s led scientists to monitor lakes and rivers throughout the UK. The table below shows some of the data obtained from a small lake during the monitoring.

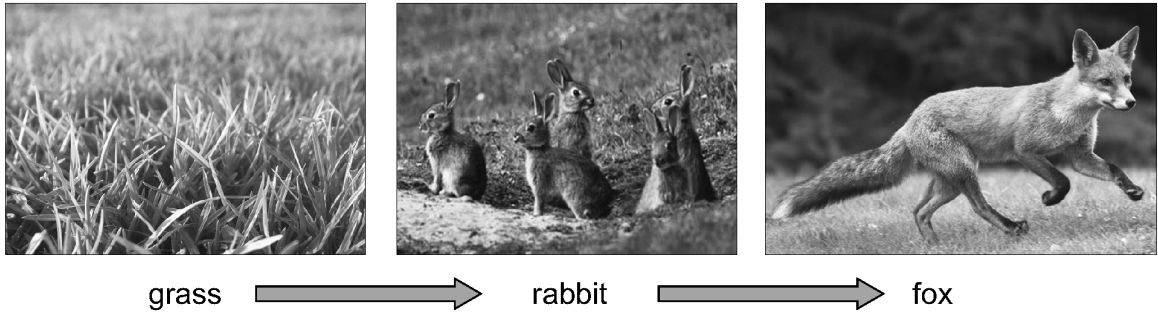
organism	biomass (kg)	concentration of DDT in organism (ppm)
pike (large fish)	22.0	5.62
algae	112 000.0	–
small insects	12 500.0	0.03
perch (small fish)	112.5	1.89
large insects	1 125.0	0.18

(b) In the space below, **draw a labelled pyramid of biomass** for the food chain containing organisms named in the table above. [2]

(c) (i) Calculate the percentage increase in concentration of DDT between the small insects and the pike. [2]

Percentage increase = %

8. The diagram shows a grassland food chain.

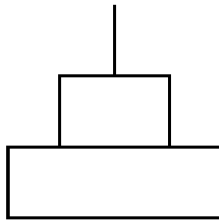


(a) Which **one** of the following words describes the rabbits? [1]

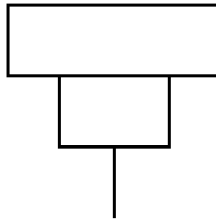
Underline the correct answer.

Rabbits are: producers herbivores carnivores

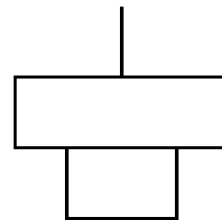
(b) Which of the following pyramids of number (A, B or C) matches the food chain? [1]



A



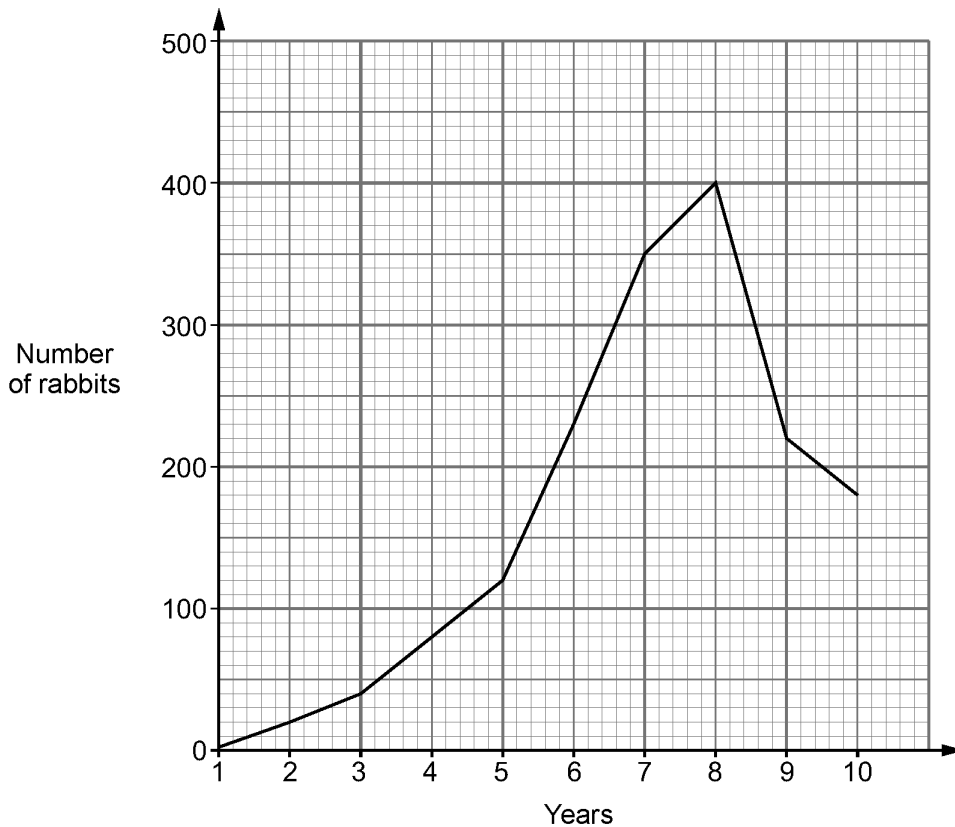
B



C

Answer

- (c) Rhian uses a computer model to investigate the population growth of rabbits on an island. The computer produces a graph of how the number of rabbits on the island might change over ten years.



Use the data from the graph to answer the following questions:

- (i) In which two year period was population growth the fastest? [1]

Between year and

- (ii) State the number of rabbits on the island in year 8. [1]

.....

- (iii) The island has an area of 2000m^2 .
At the start, there are 2 rabbits on the island, so the area for each rabbit is 1000m^2 .
Calculate the area for each rabbit in year 8. [1]

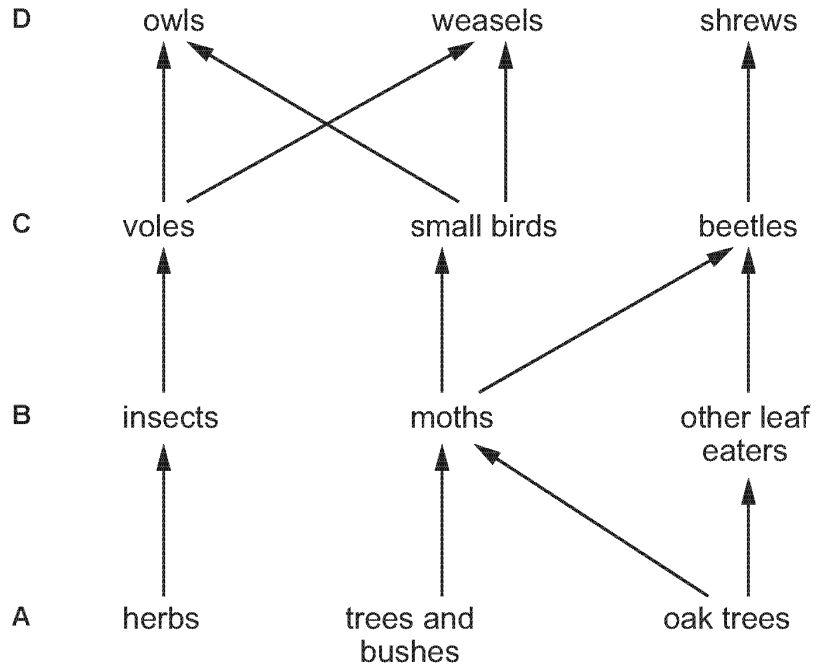
Answer m^2

- (iv) Calculate the fall in the number of rabbits between years 8 and 10. [1]

Answer

9.

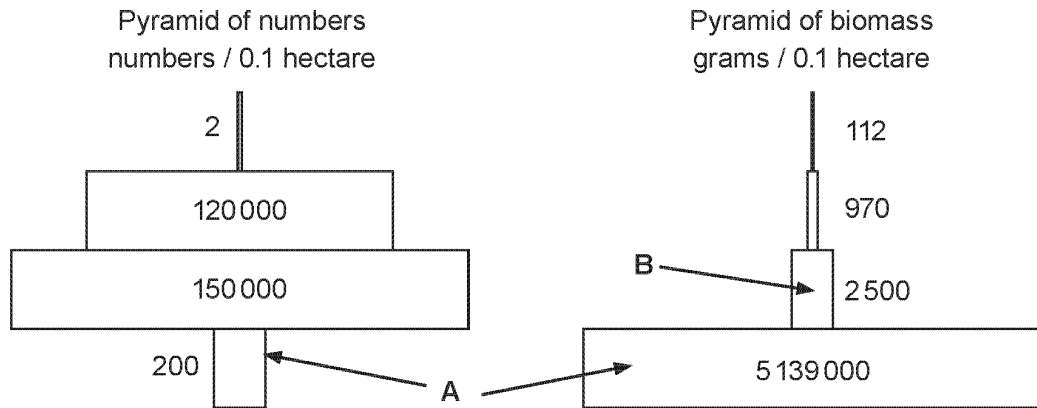
The diagram below shows a food web for a woodland.



(a) The food web shows four different trophic levels. Give the term used to describe each of the trophic levels. [1]

- A
- B
- C
- D

- (b) The diagrams below show a pyramid of numbers and a pyramid of biomass for a food chain in this food web.



- (i) Calculate the percentage of biomass passed from trophic level A to trophic level B. [2]

Percentage of biomass = %

- (ii) Explain why the trophic level labelled A is such a different width in the two pyramids. [2]

.....

.....

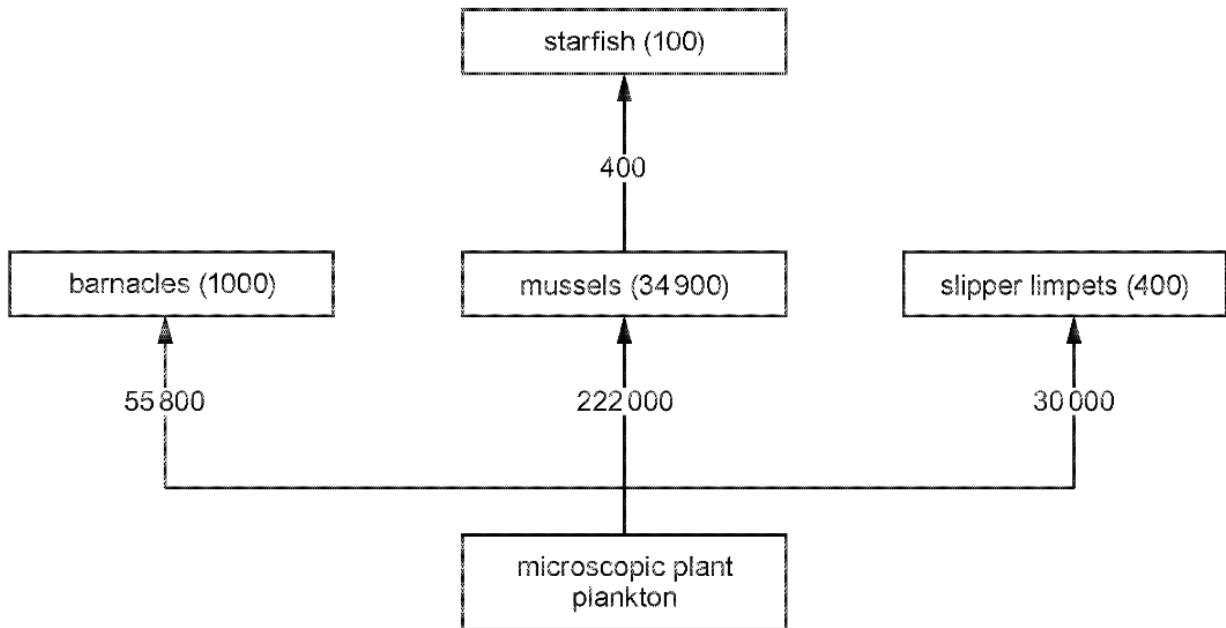
.....

- (iii) State **one** way in which energy is lost between trophic levels. [1]

.....

.....

10. The flow diagram shows the transfer of energy between organisms on a rocky shore. Numbers on the arrows show the energy available to the organisms in kJ per m² per year. Numbers in brackets show the energy that becomes part of the biomass of the organisms in kJ per m² per year.



The energy efficiency of an organism is a measure of how much of the energy available to the organism becomes part of its biomass. It is calculated by using the following equation:

$$\% \text{ energy efficiency} = \frac{\text{energy that becomes part of biomass}}{\text{energy available}} \times 100$$

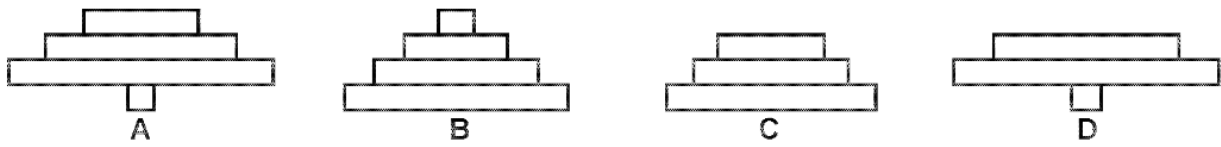
- (a) (i) Calculate the energy efficiency of the starfish. [2]

energy efficiency = %

- (ii) Calculate the percentage of the energy entering the mussels that enters the starfish to **three** significant figures. Show your working. [3]

percentage of the energy entering the mussels = %

(b) The diagrams show pyramids of numbers for four ecosystems.

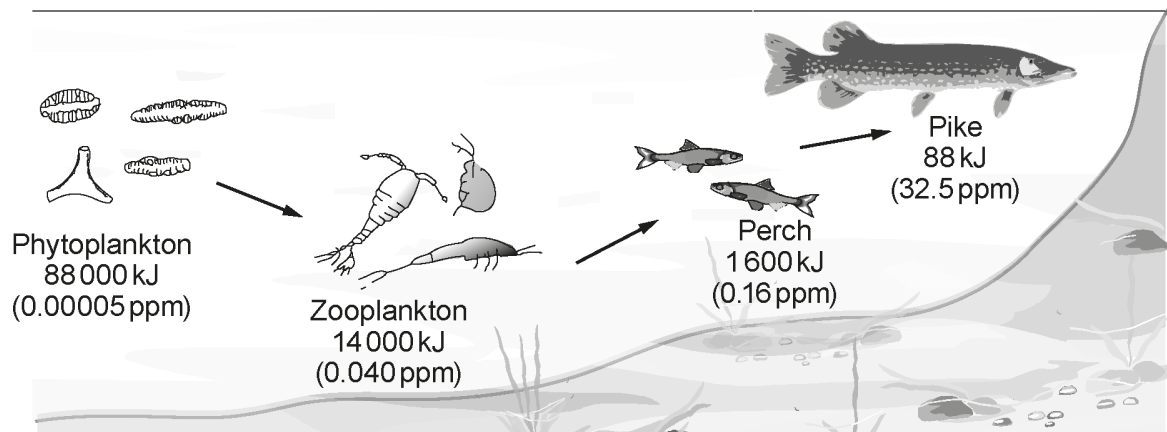


Which **one** of the pyramids of numbers represents the flow diagram of this rocky sea shore? State a reason for your answer. [2]

.....
.....

7

11. The drawing below shows a food chain in a river into which a pesticide has been washed.



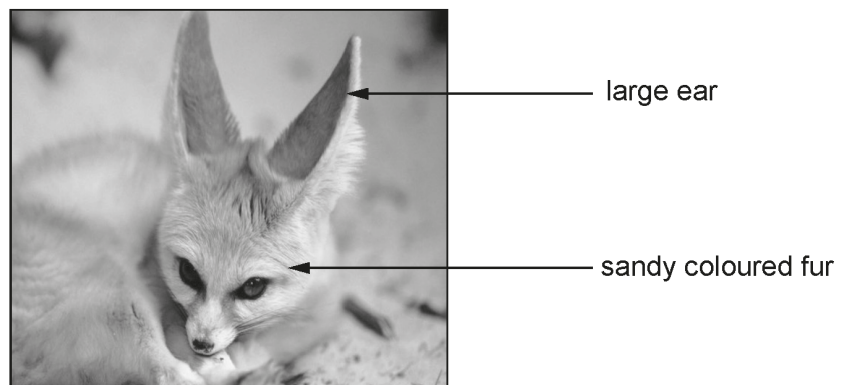
The organisms are not drawn to scale.

The unit, kJ, indicates the energy in organisms at each level of the food chain and represents kJ per m³ of water per year.

The numbers in brackets show the pesticide concentration in parts per million (ppm).

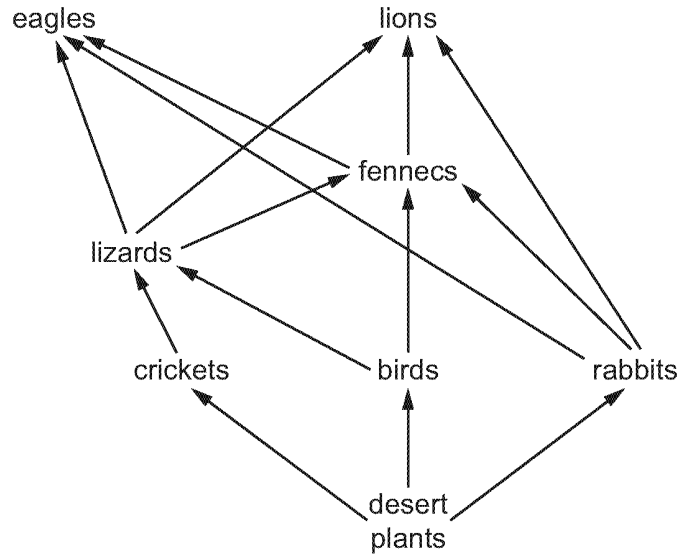
- (a) Calculate, the percentage of the energy in the producer that has reached the third stage consumer. **Show your working.** [2]

12. The photograph shows a fennec.



- (b) Fennecs live in hot, sandy deserts.

(ii) The diagram below shows a desert food web which includes fennecs.



I. State the number of carnivores in the food web. [1]

.....

II. Use information in the food web to explain why sandy coloured fur is useful to fennecs. [2]

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

(c) Complete the following sentence by underlining the correct answer. [1]

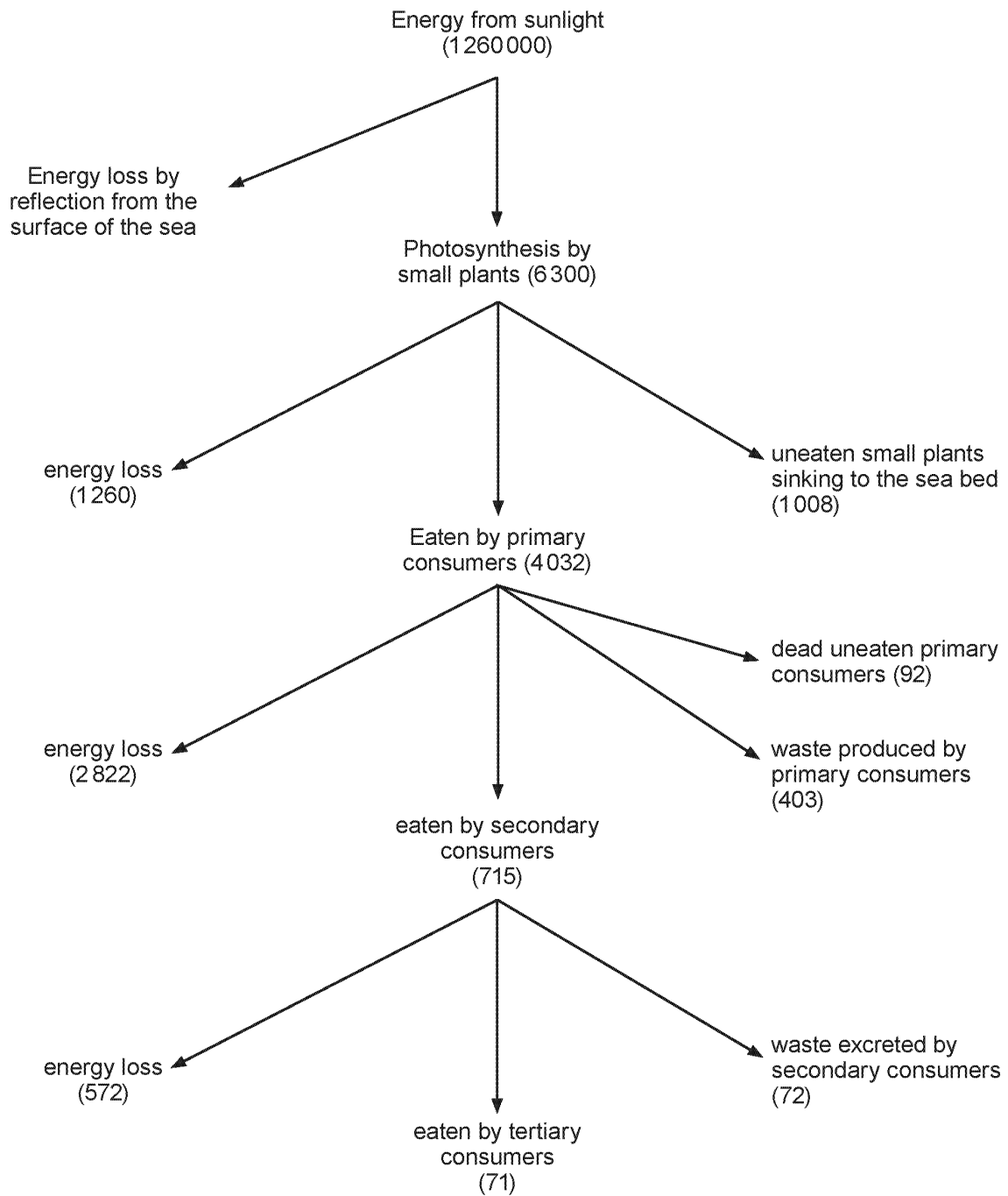
In a food web the organisms with the largest total biomass are the

producers

herbivores

carnivores

13. Scientists from the British Antarctic Survey produced a flow chart to represent the energy flow in kJ per m² per year in an area of the Antarctic. The flow chart is shown below.



Use the flow chart and your knowledge to answer the following questions.

- (a) State the main process occurring in the cells of living organisms which leads to the *energy loss* shown in the flow chart. [1]

.....

- (b) Calculate the total energy available to decomposers. [1]

Total energy available to decomposers = kJ/m²/year

- (c) Calculate the percentage of the energy from sunlight that is used by the small plants. [2]

Percentage of the energy from sunlight that is used by the small plants = %

14. The photograph shows an insect called an aphid (*Aphis*).



Aphids damage crops such as barley, by making holes in the leaves. They then suck out sugar solution through the holes. A thick layer of fungi can then grow on the damaged leaves, so they absorb less light energy.

Farmers may use pesticides on their crops. Pesticides are effective, but may also be toxic to harmless organisms. Another approach is to release insects such as ladybirds onto the crop. Ladybirds are secondary consumers that are common in many food chains. They target pests such as aphids and so reduce their numbers.

(a) Using **only** the information above, give the evidence that:

(i) barley is photosynthetic; [1]

.....

(ii) aphids are primary consumers; [1]

.....

(iii) ladybirds are carnivores; [1]

.....

(iv) using ladybirds is less likely to damage the environment than using pesticides. [2]

.....

.....

.....

- (b) (i) A farmer growing barley aims to harvest 8.0 tonnes/hectare.
Aphids reduce her harvest by 15 %.

Calculate the loss due to the aphids in tonnes/hectare.

[2]

loss = tonnes/hectare

- (ii) The farmer is paid £117.00 per tonne for her barley.

Use your answer to (i) to calculate how much money the farmer loses per hectare due to aphid damage.

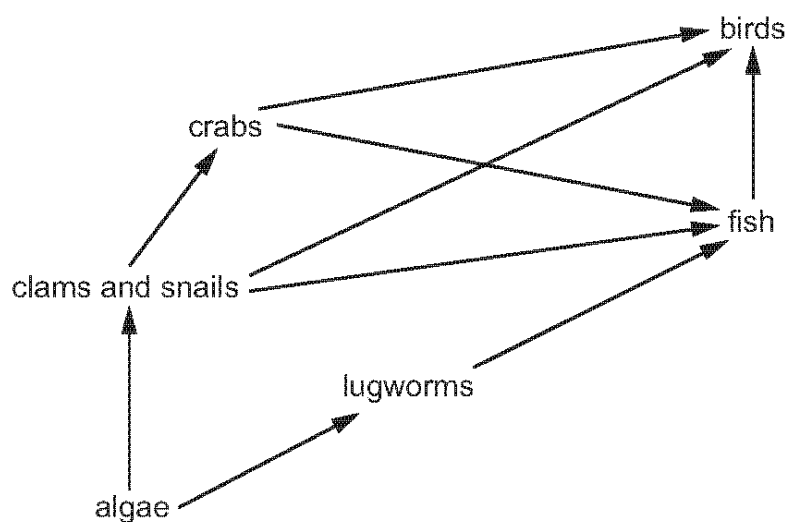
[1]

loss = £..... per hectare

15. A very large biomass and variety of organisms live in the sand and mud of seashores. The table shows the composition of invertebrates living in sand and mud on a seashore in Cardigan Bay in west Wales.

	living in mud	living in muddy sand	living in sand
total invertebrates (per m ³)	15000	700	200
average number of different species of invertebrate herbivores (per m ³)	25	45	28
average number of different species of invertebrate carnivores (per m ³)	10	20	15

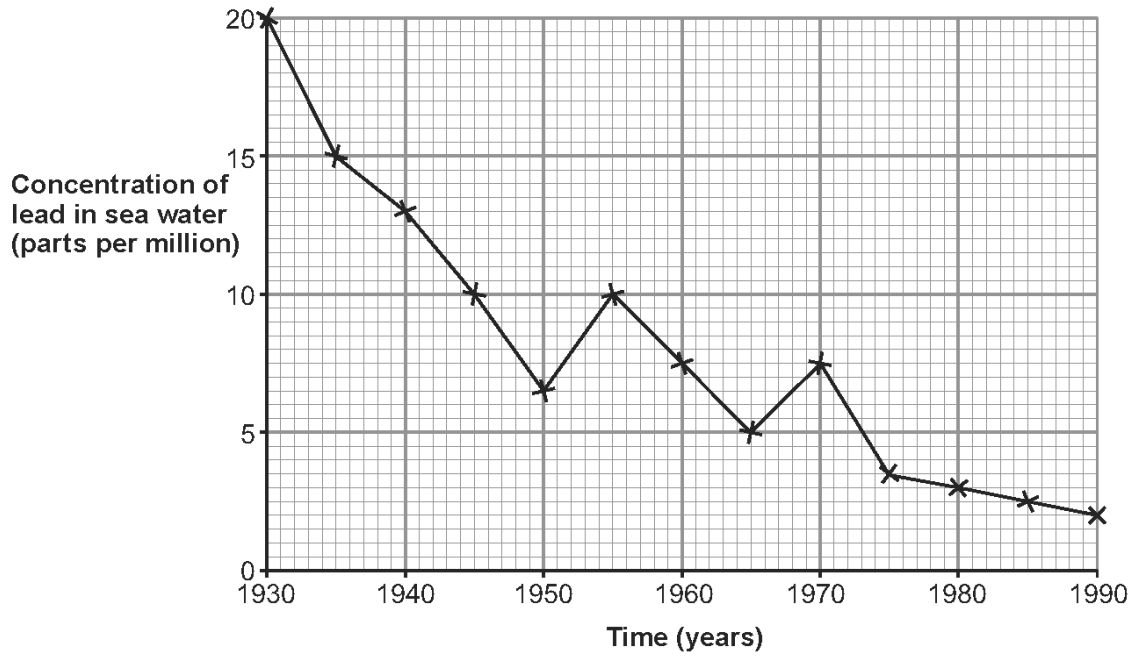
(b) A simplified food web for a muddy shore is shown below.



Certain species can be used to monitor pollution of sea water by heavy metals. Which organism in the food web would be expected to have the highest concentration of heavy metals? [1]

.....

- (c) Lead pollution has been monitored in Cardigan Bay for many years. The results are shown in the graph below.



- (i) What was the general trend in the concentration of lead pollution in Cardigan Bay from 1930 to 1990? [1]

- (ii) Use the graph to calculate the percentage decrease between the maximum and minimum concentrations of lead. Show your working in the space below. [2]

Percentage decrease %

16. Waders are species of birds which feed in shallow water and nest on land. The table below shows numbers of breeding pairs of four species of waders on two Scottish islands, Islay and Arran, in 1983 and 2000.

	number of breeding pairs of waders			
	Islay		Arran	
wader	1983	2000	1983	2000
Lapwing	1869	1287	1104	1364
Redshank	1288	760	486	733
Dunlin	2016	884	803	558
Snipe	655	280	172	154

- (a) Calculate the percentage decrease in the number of breeding pairs of snipe on Islay between 1983 and 2000. [2]

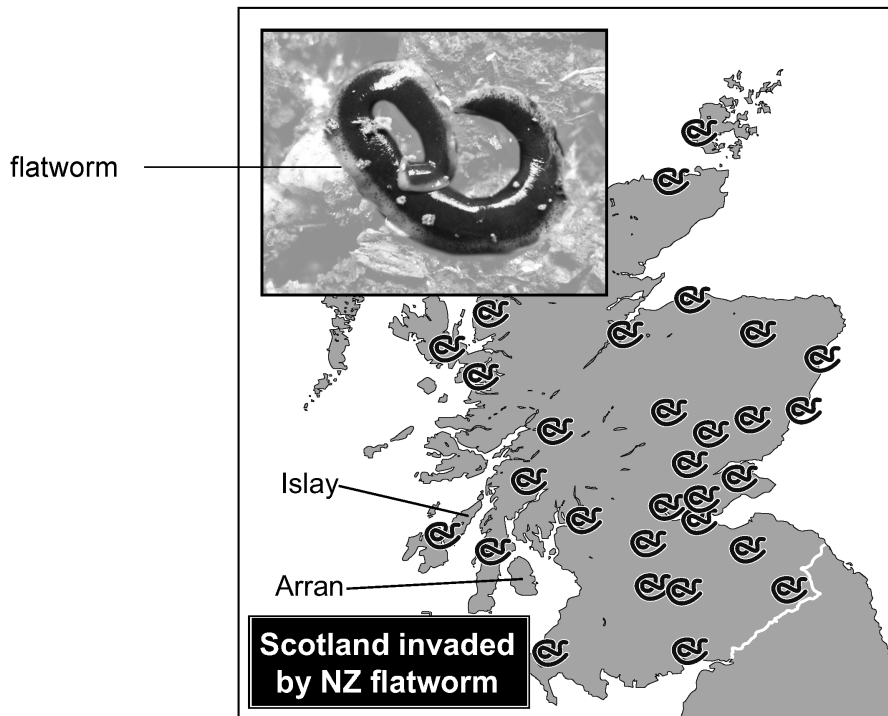
Percentage decrease %

- (b) Four hedgehogs were introduced to Islay in 1974. No other carnivorous mammals live on the island. By 1983, the population of hedgehogs on the island was very large.

In the 1980s, a species of flatworm from New Zealand, was accidentally introduced to Islay.

Arran has remained free of hedgehogs and flatworms.

17.



- Hedgehogs eat invertebrates and the eggs of waders.
- Flatworms do not eat birds' eggs, but eat the same types of invertebrates as hedgehogs.
- Hedgehogs do not eat flatworms.

(i) Explain why the number of waders on Islay has decreased since the introduction of the flatworm. [2]

.....

.....

.....

(ii) How does the data from Arran suggest that predation may **not** be the only reason for the decrease in the number of waders? [1]

.....

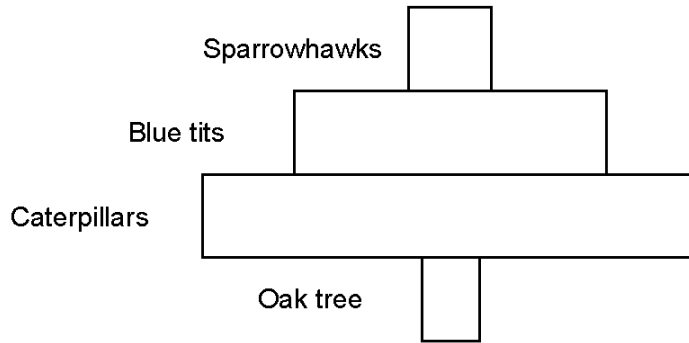
.....

(iii) Suggest **two** factors that have allowed a large increase in the population of hedgehogs on Islay. [2]

.....

.....

The diagram below shows the pyramid of numbers for a food chain found in a small wood.



- (a) (i) Show the correct relationship in the food chain by adding **one** of the following numbers to **each** of the feeding levels in the above pyramid of numbers. [1]

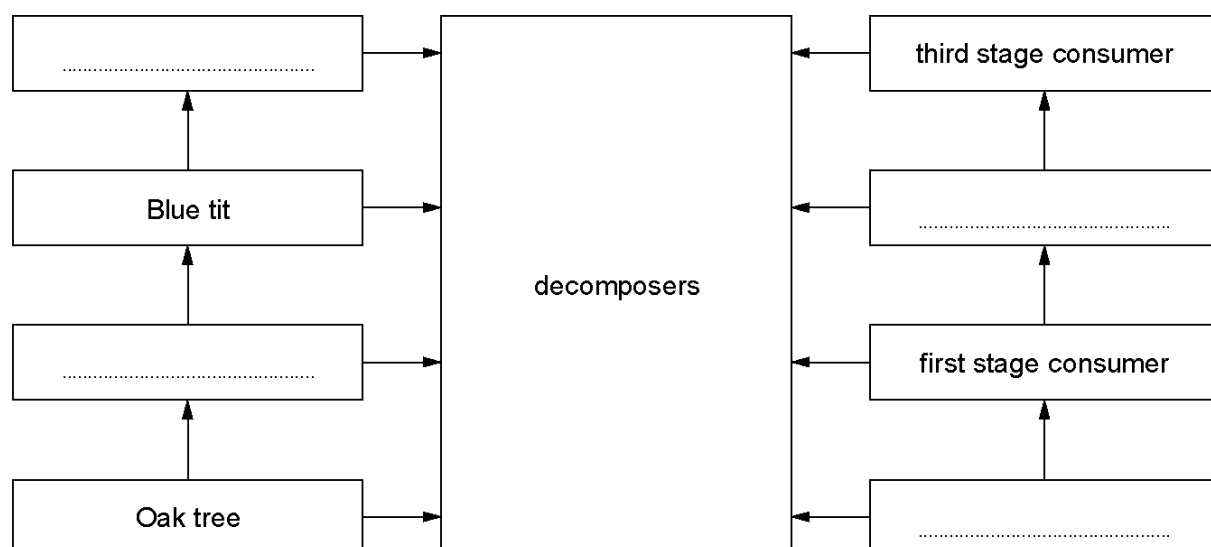
1 17 3456 2

- (ii) I In the space below draw a **labelled** pyramid of biomass for this food chain. [1]

- II Show the correct relationship in the food chain by adding **one** of the following masses to **each** of the feeding levels in **your** pyramid of biomass shown in a(ii) I. [1]

0.18 kg 5137 kg 1.2 kg 43 kg

(b) Use the information on the opposite page and your own knowledge to complete the following diagram. [2]



(c) In which of the following do **all** of the processes add carbon dioxide to the air? Underline the correct answer. [1]

- (i) decomposition *and* respiration *and* photosynthesis
- (ii) decomposition *and* respiration *and* photosynthesis *and* combustion
- (iii) respiration *and* combustion *and* photosynthesis
- (iv) respiration *and* combustion *and* decomposition

6

18.

The photograph shows a farmer spraying crops with a pesticide.



(a) Explain why spraying crops with pesticides may increase crop yield on farms. [2]

.....

.....

.....

.....

(b) Some pesticides have harmful side effects.

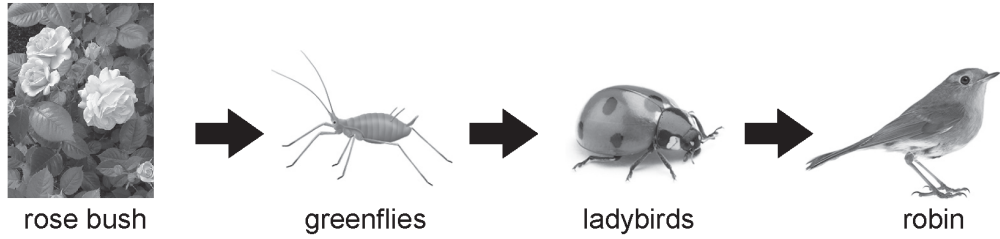
Choose words from the list below to complete the following sentence. [4]

nitrates DDT toxic consumers producers disease fertility

Pesticides such as may build up in food chains to
..... levels causing reduced or
death to third stage

19.

The diagram shows a garden food chain.



(a) State:

(i) the source of energy for all organisms in the food chain; [1]

.....

(ii) what is shown by the arrows in the food chain? [1]

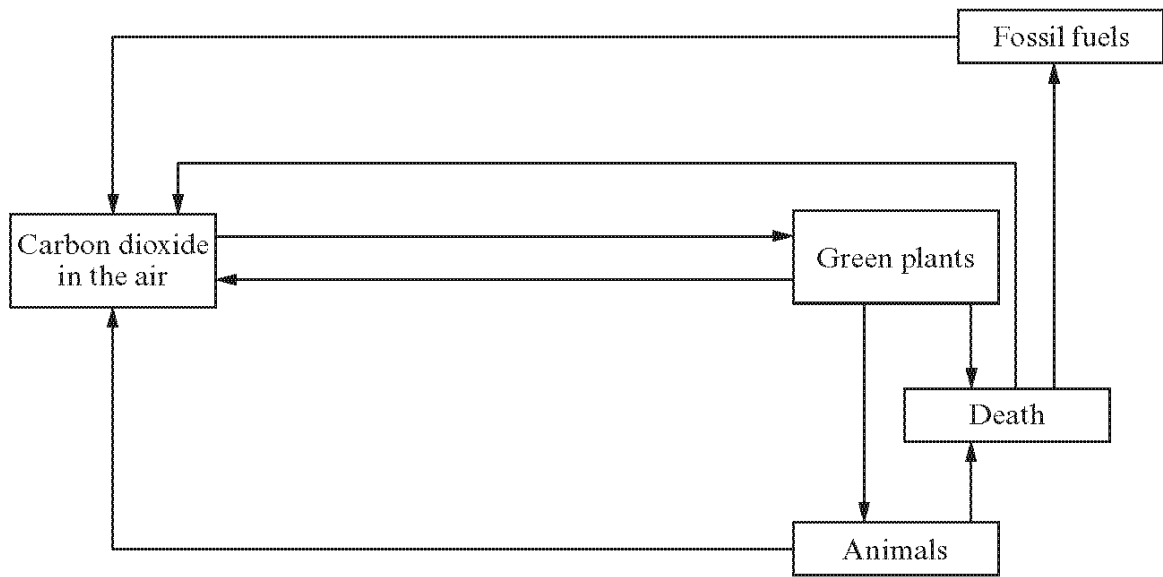
.....

(b) In the space below, **draw a pyramid of biomass** to represent the four stages in the food chain. No labels are required. [1]

(c) The gardener sprays chemical pesticide onto the greenfly. Explain how this action will affect the number of robins. [2]

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

20. The diagram shows the basic outline of the carbon cycle.



Use the diagram above and your own knowledge to explain in detail how carbon is cycled in nature. Start your account with carbon dioxide being taken up by green plants. [6 QWC]

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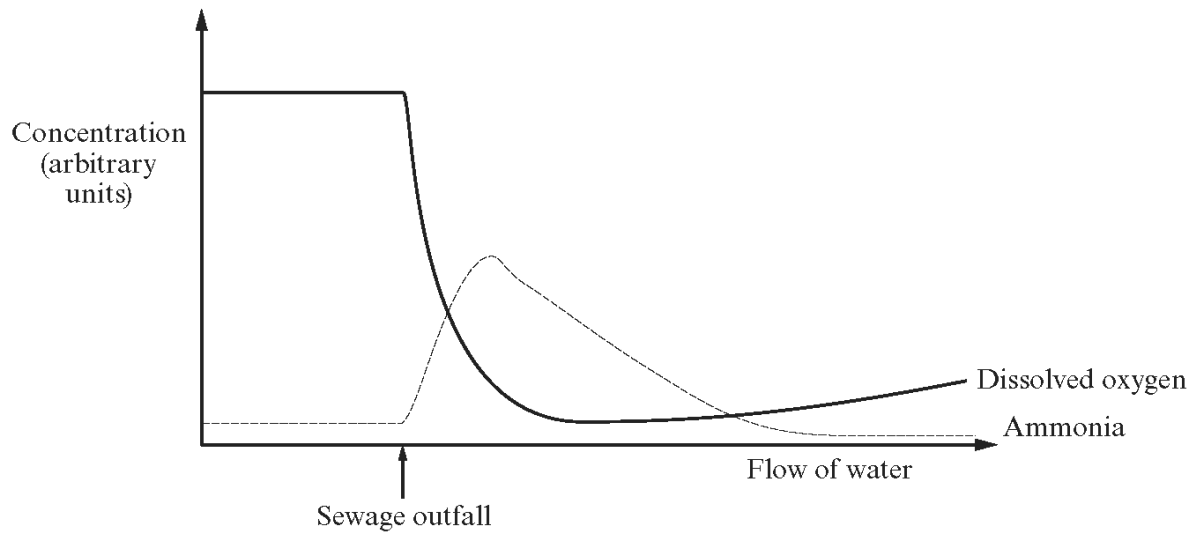
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21. In order to monitor environmental pollution, measurements of some chemical factors of water were made in a river at points above and below a sewage outfall. The results are shown in the graph below.



- (b) Use the graph **and your own knowledge** of the nitrogen cycle to describe and explain the changes in concentration of ammonia shown in the graph. [4]

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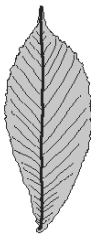

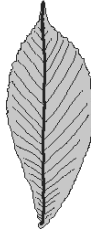

.....

22.

Tracy investigated decay using two leaves of the same size from the same tree.

- She made a drawing of each leaf.
- She then buried each leaf in a separate beaker each containing equal volumes of soil.
- She kept one beaker at 5°C and one at 15°C.
- After one month, she removed the leaves from the soil and drew them again.

Her drawings are shown in the table below.

Temperature (°C)	Drawing of leaf	
	start	after one month
5		
15		

(a) State the name of **one** group of microorganisms that cause decay. [1]

.....

(b) Describe the results of the investigation shown by the drawings. [2]

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

(c) (i) Give two ways that Tracy's investigation is a fair test. [2]

I.

II.

(ii) Why is it important that an investigation should be a fair test? [1]

.....

.....

(d) Microorganisms in the soil respire.

State the name of the gas released during respiration. [1]

.....

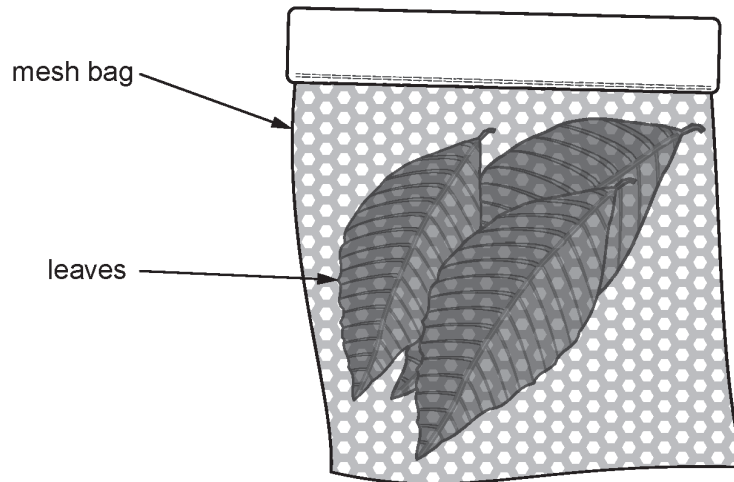
(e) State why the level of nitrates in the soil in the beakers would increase during the investigation. [2]

.....

.....

.....

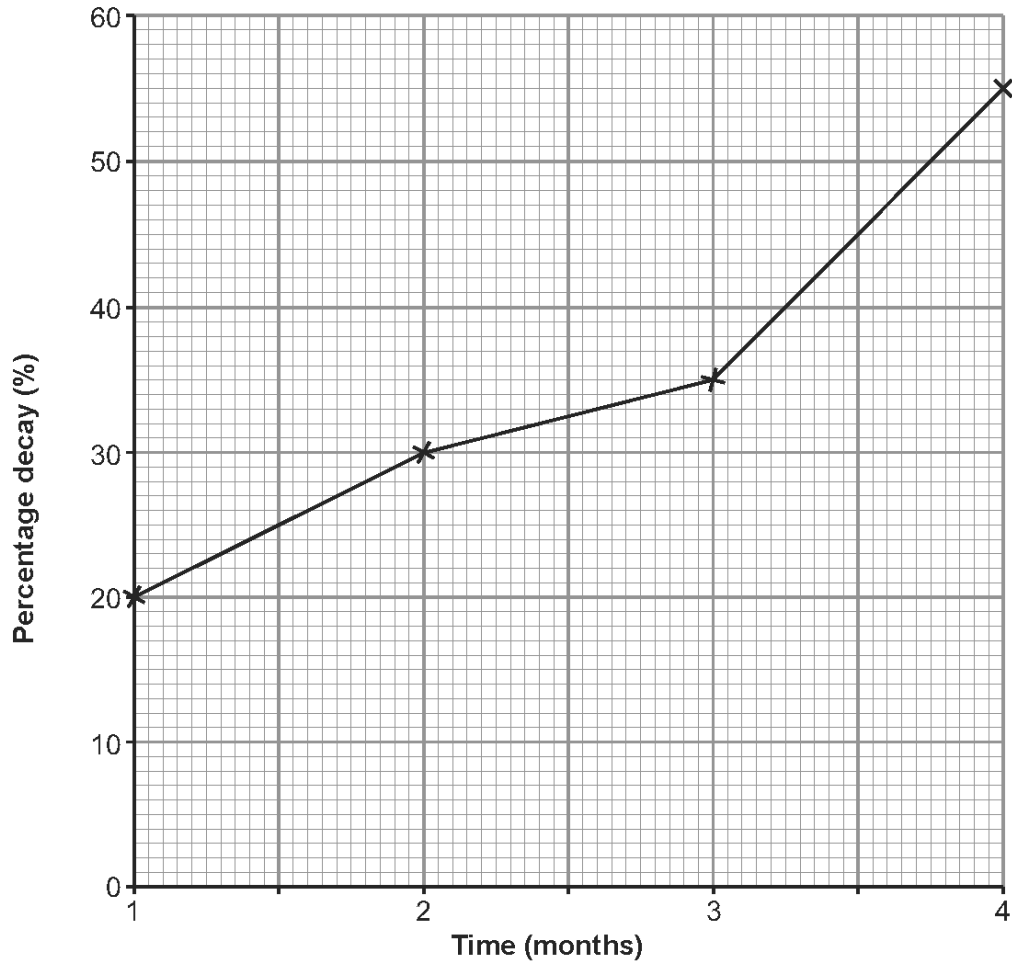
23. Students investigated the decay of leaves in woodland soil. The students put the leaves in bags of two different mesh sizes. The bags were buried in soil for four months. One of the bags is shown below.



The bags were dug up at the end of each month and the percentage (%) decay was measured. The results are shown in the table.

mesh size (mm)	percentage (%) decay			
	month 1	month 2	month 3	month 4
1.0	20	30	35	55
0.1	13	23	26	42

- (a) (i) Complete a line graph of these results on the grid opposite.
The results for one mesh size have been plotted for you.
- I. plot the points for the other mesh size, [2]
 - II. join the points with a ruler, [1]
 - III. label the **two** lines. [1]



(ii) Describe the effect of **mesh size** on the percentage decay of the leaves. [1]

.....

.....

(iii) Give **two** features of the leaves that should be controlled at the start of the investigation. [2]

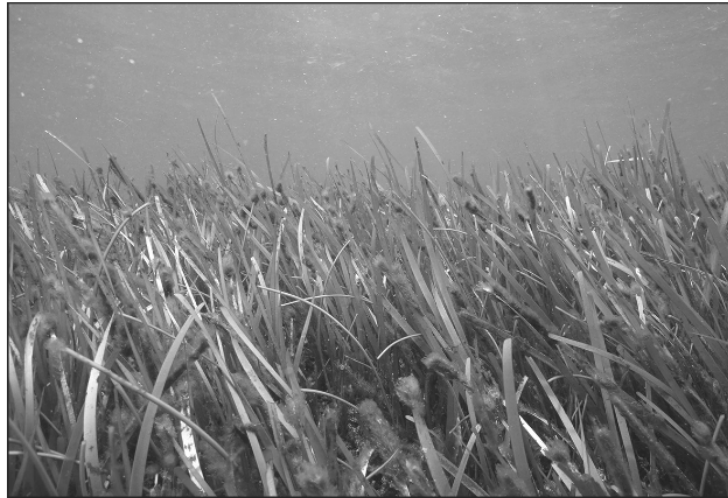
- I.
- II.

(iv) The decay is caused by microorganisms. Give the name of **one** type of decay causing microorganism. [1]

.....

24.

Read the information about seagrass and use it to answer the questions.



Seagrass growing on the sea bed

Seagrass is a green plant which lives in the sea. It covers large areas of the sea bed.

Human activities such as dredging, building and industrial development can destroy seagrass. In the 1950s the loss of seagrass was 1.5 % per year but since 1990 scientists have calculated the loss to be 7 % per year.

Fisheries need sea grass. In the Mediterranean Sea, between 30 % and 40 % of the fish caught feed on seagrass and in Indonesian seas this is 60 %.

Seagrass is important in the carbon cycle, taking in carbon dioxide to produce glucose. This is converted into another carbon compound which can be stored in its large roots. Carbon dioxide makes sea water acidic which is harmful to sea organisms.

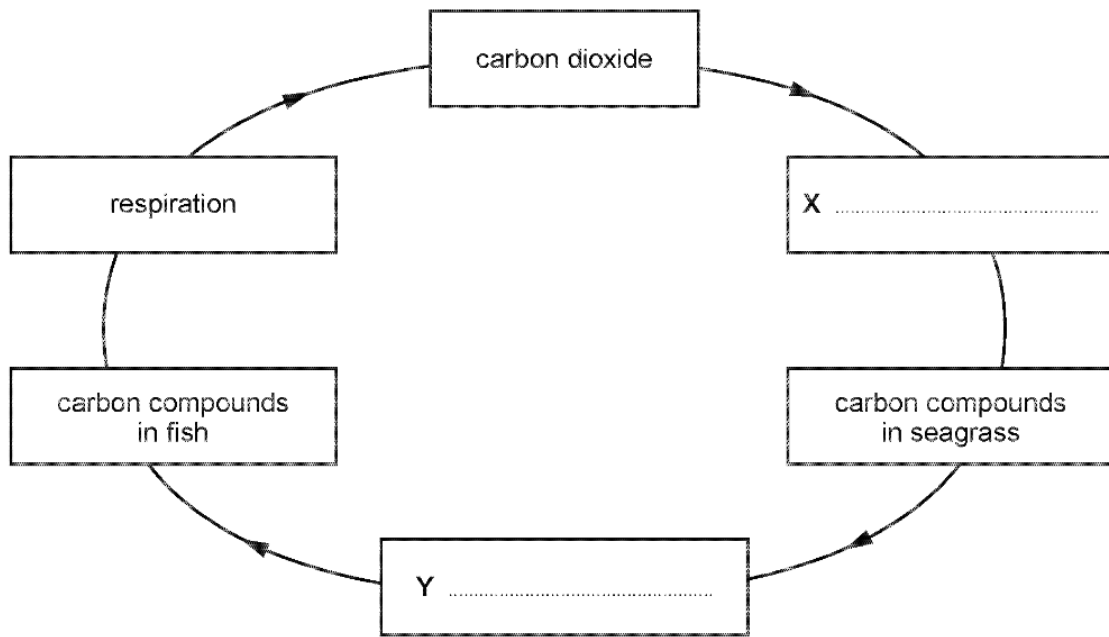
(ii) Which of the following statements describes the rate at which seagrass has been lost since 1950? [1]

- A It has been constant every year
- B It has increased
- C It has decreased
- D It has increased in some years and decreased in others.

Answer

(c) Answer the following questions using the information given and your own knowledge.

- (i) Complete the diagram below which shows part of the carbon cycle, by naming processes X and Y. [2]



- (ii) Name the carbon compound stored in the roots of seagrass.

[1]

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25. Urea is an animal waste substance which contains nitrogen. Explain how nitrogen in the urea from cattle in a field of grass is recycled to become protein in beef. [6 QER]

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26. Describe how nitrogen is recycled through the activity of soil bacteria and fungi to make it available to plants. In your description you should also refer to the factors that affect the activity of soil bacteria and fungi during the recycling process. [6 QWC]

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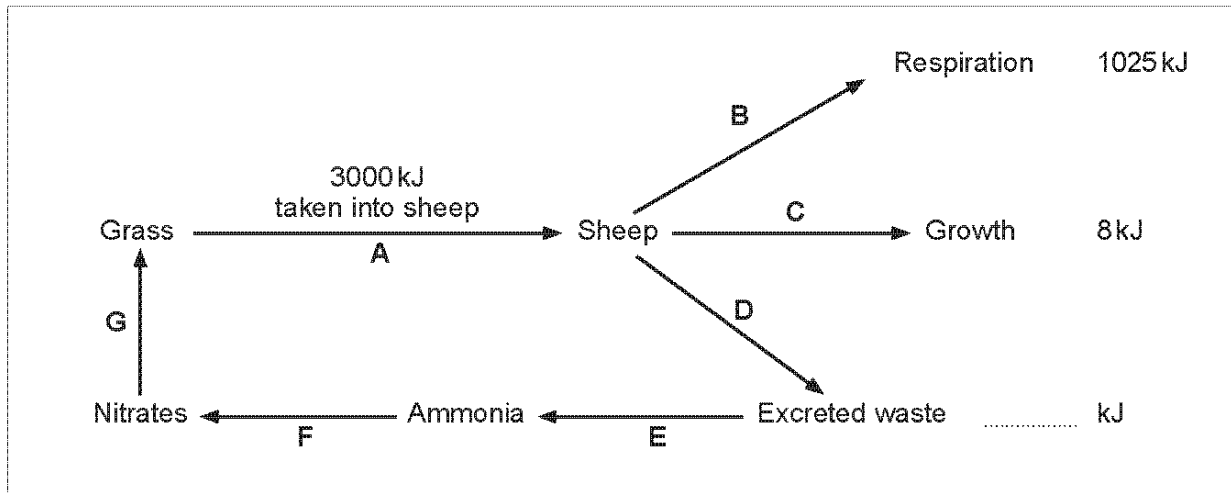
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27. The following flow chart shows part of the nitrogen cycle. It also shows the energy relationships between some organisms and their environment.



- (a) (i) Complete the flowchart above to show how much energy is in the excreted waste. [1]
- (ii) Calculate the percentage of the energy taken into the sheep which is used in growth. Show your method in the space below. [1]

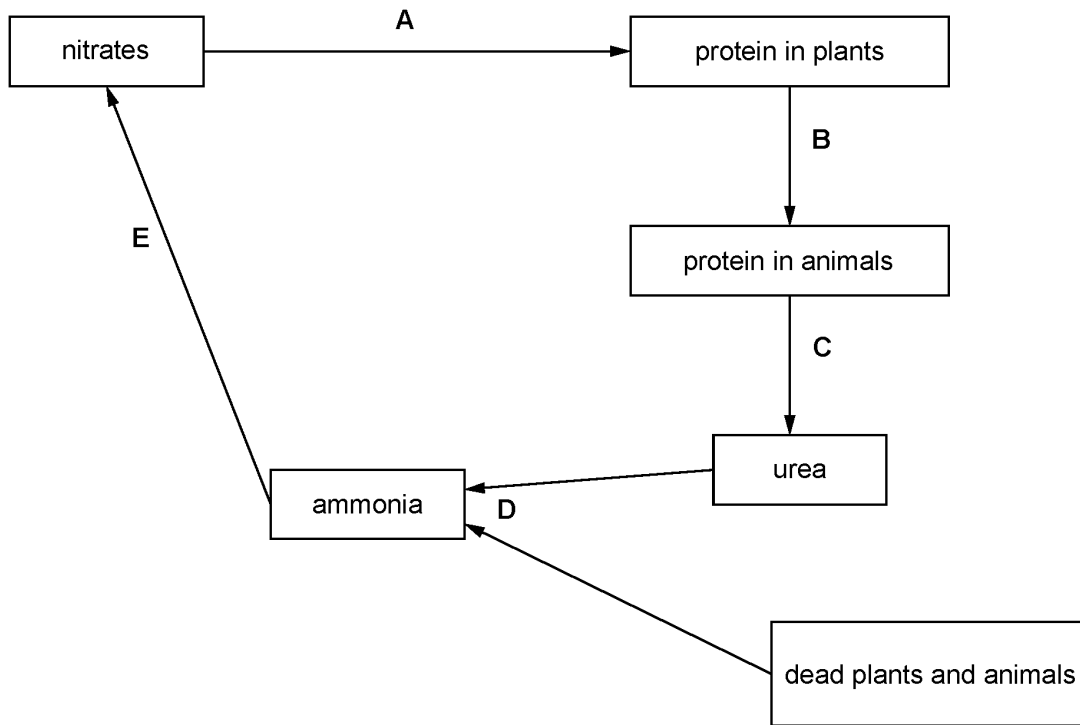
Answer %

- (b) Use the flow chart above to state

(ii) a letter which represents protein production

28.

(a) The diagram below shows some stages of the nitrogen cycle.



Use the diagram to match the correct letter with the name of the process given in the table below. [2]

process	letter
absorption by plants	
decay by decomposers	
feeding	
excretion	

- (b) During the severe flooding in North Wales in November 2012, raw sewage was washed into a lake. The concentration of nitrate in this lake was measured before and after the flooding. The table below shows the results.

time	concentration of nitrate (mg/l)
October 2012	0.4
November 2012	1.0
January 2013	2.2
May 2013	63.0

Use the data in the table above, the diagram of the nitrogen cycle in part (a) and your knowledge to describe and explain the change in the nitrate concentration throughout this period. [5]

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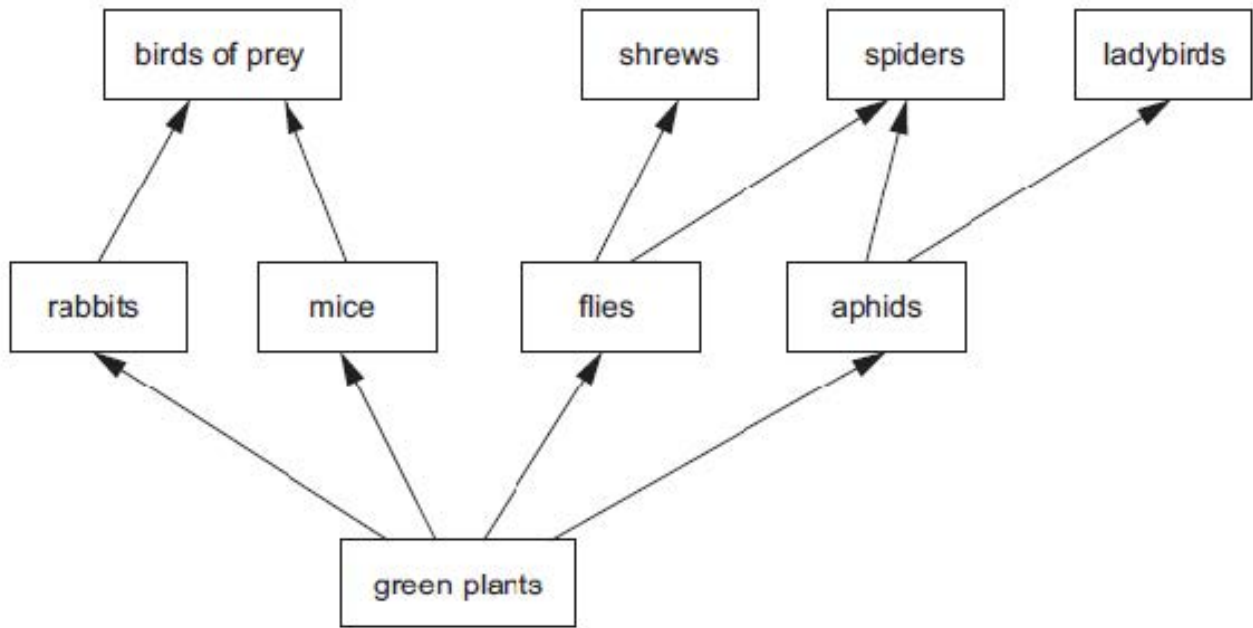
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29. The diagram below shows a food web in an area of grassland.



Farmers were concerned that the rabbit population was increasing and called in a pest control company to destroy the rabbits.

(a) Identify the herbivores and second stage consumers in the food web above. Explain how the populations of each would be affected if all the rabbits were destroyed. [6 QER]

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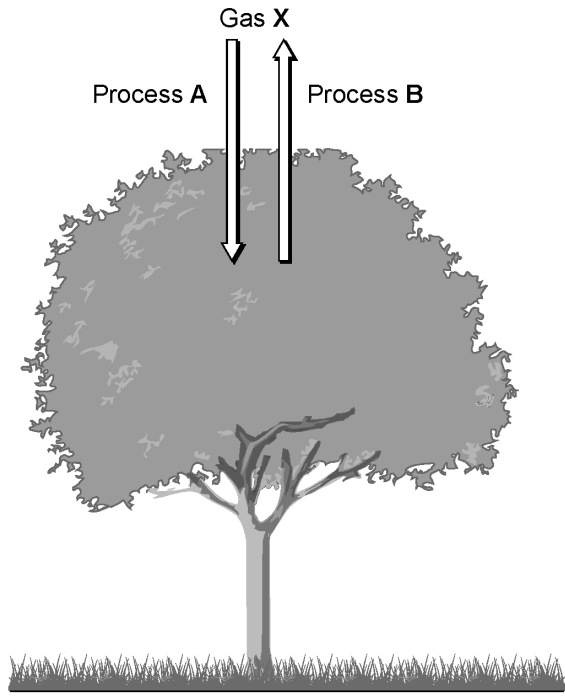
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 (b) Explain how the levels of mineral nutrients in the soil would be increased if the dead bodies of rabbits were not removed by the pest control company. [2]

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30. The diagram shows the role of a tree in part of the carbon cycle.



- (a) From the diagram of part of the carbon cycle, state the name of:
- (i) process A, which uses gas X to make sugar [1]
 - (ii) process B, which releases gas X [1]
 - (iii) gas X [1]
- (b) The fallen leaves of the tree are collected and burnt.
 How does burning (combustion) affect the carbon cycle? [1]

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31. The following article appeared on the BBC news website on the 13th of April 2010.

A “perfect storm” of nutrients from sewage effluent and unusual weather conditions has been blamed for a 2009 outbreak of toxic algae in a lake.

1 Llyn Padarn at Llanberis was closed to leisure users for much of last summer.

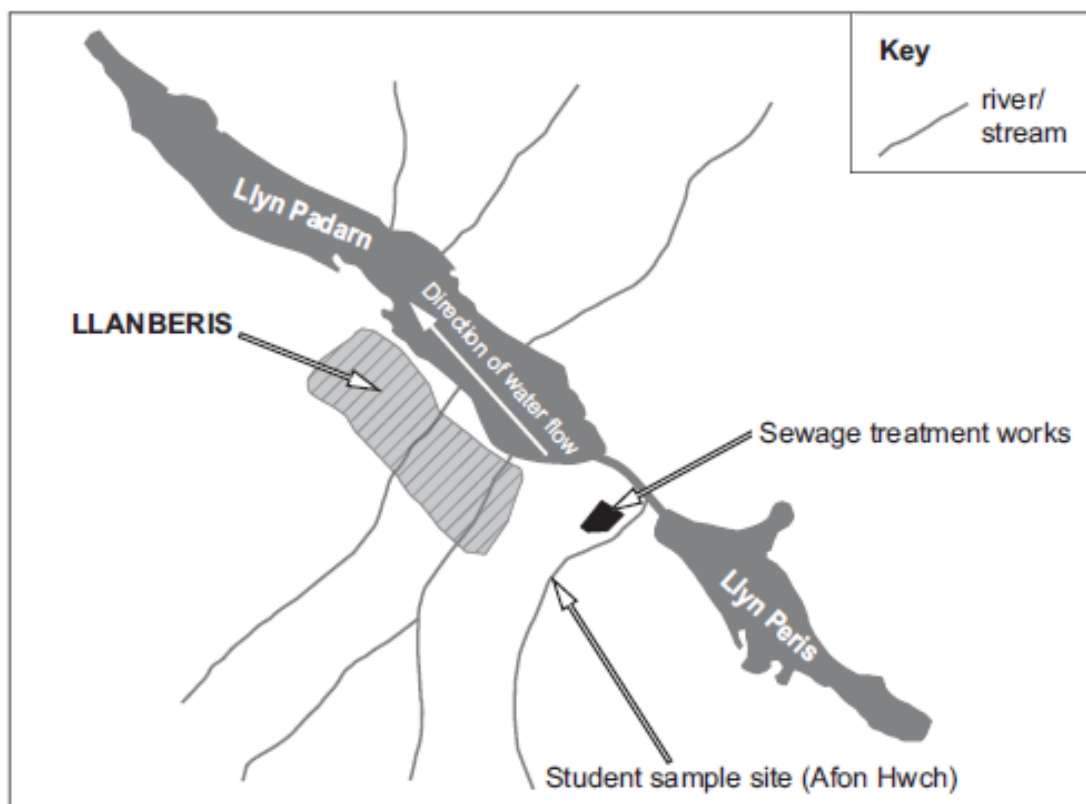
A report commissioned by Environment Agency Wales calls for stricter limits on effluent discharged from the local sewage treatment works.

5 The report by Professor Glen George described the warm spring, followed by a still June and a wet July and August as “the perfect storm”.

He said the weather conditions, combined with nutrients in the lake, not only created the right conditions for the algal bloom to form but also meant it continued through the summer.

10 His report makes a number of recommendations for further scientific studies of the lake and more work to find out how the management of the sewage treatment works in Llanberis is affected by heavy rain.

The map below shows Llyn Padarn and the surrounding area.



Llyn Padarn is also home to a rare breed of fish called the Arctic char fish (*Salvelinus alpinus*). The char feeds on insects found on the water's surface, fish eggs and snails found on the lake bottom.

- (a) Explain how the **unusual weather** conditions in 2009 referred to in lines 4 and 5 contributed to the outbreak of algae. [2]

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- (b) Explain why the local fishermen thought that the algal blooms could lead to a decrease in the population of the arctic char. [3]

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Students from a local school carried out a survey on the Afon Hwch, a river that flows into Llyn Padarn, during July of 2009. The site of the survey is shown on the map on page 14. The results are recorded below:

Number of organisms						
stonefly nymph	mayfly nymph	caddis fly larvae	blood worm	leeches	sludge worms	rat tailed maggot
3	17	7	0	5	0	0

The following table can be used to assess the condition of the water.

Organism present	Levels of pollution	Oxygen concentration
no visible life	very high	no oxygen
rat tailed maggot	high	low
sludge worm		
leeches	moderate	moderate
blood worm		
caddis fly larvae	low	moderate to high
mayfly nymph	none	high
stonefly nymph		

- (c) (i) State the scientific term which is used to describe organisms that are used to detect levels of pollution. [1]

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- (ii) Consider the information provided to describe the water conditions in the Afon Hwch. [2]

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- (iii) It was recommended that further scientific studies were needed to show that the algal blooms were not caused by fertilisers used on the land around the lake. Describe how students could extend their survey to test this idea. [2]

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32.

Give a brief description of the advantages and disadvantages of each of the following intensive farming methods:

- use of fertilisers
- use of pesticides
- use of battery methods in rearing animals

[6 QWC]

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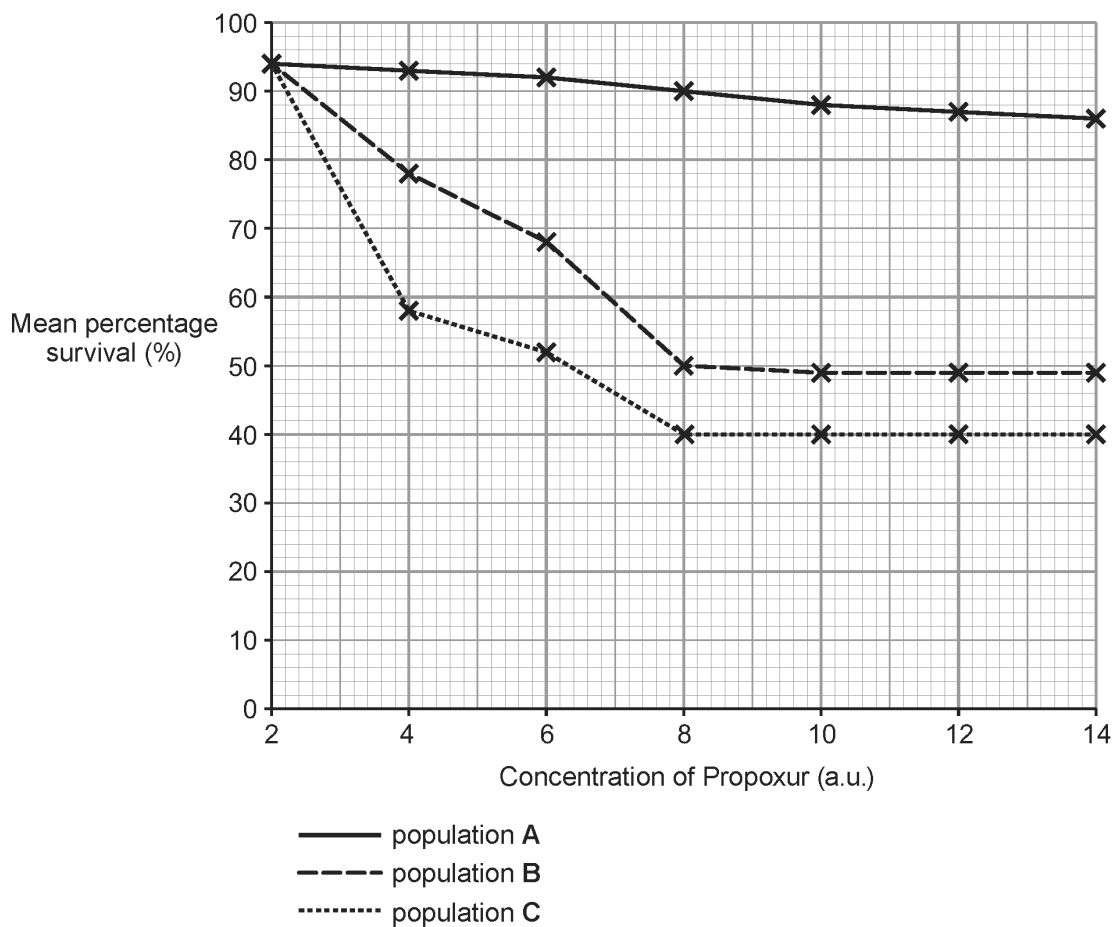
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33.

The photograph below shows a mosquito (*Aedes aegypti*) feeding on a human.



The pesticide, Propoxur, has been used to control mosquitoes in South America. In 2016, an outbreak of a disease caused by a virus which is carried by mosquitoes occurred in South America. Scientists investigated the effectiveness of Propoxur under controlled conditions in a laboratory. They used 200 mosquitoes of the same species from each of three separate populations A, B and C and subjected them to a range of concentrations of Propoxur. They calculated the percentage survival of the mosquitoes for each concentration of Propoxur. The results are shown in the graph below.



(a) Use the data in the graph to answer the following questions.

- (i) Which population, **A**, **B** or **C** is the most resistant to Propoxur? Give a reason for your choice. [1]

Population

Reason

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- (ii) What is the optimum concentration of Propoxur to use to control the mosquitoes in population **C**? Explain the reason for your choice. [3]

Concentration a.u.

Reason

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- (b) State two factors, other than any given in the question, that should be kept constant to make this a fair test. [2]

1.

34.

The photograph below shows crops being sprayed with herbicides.



(a) Explain how herbicides increase crop yield.

[2]

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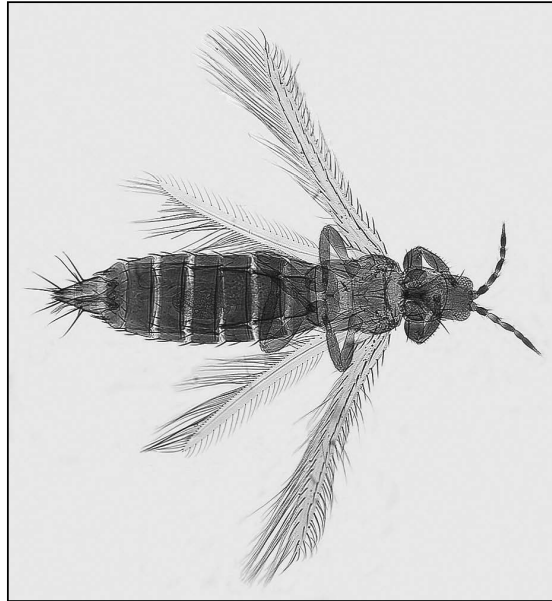
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35.

Intensive farming methods use very large amounts of chemical pesticides to increase crop yields.

The Western flower thrips (*Frankliniella occidentalis*) is an insect which eats crops, including fruit and vegetables, causing world-wide damage.



A Western flower thrips

Scientists at Swansea University have done research into pest control using bacteria which naturally live only in the thrips. The bacteria affect a gene which controls eating in the thrips. The thrips stops feeding and dies. The bacteria pass naturally between the thrips.

- (a) Use the information above to suggest **one** advantage to the farmer of using this new method of pest control over the use of chemical pesticides. [1]

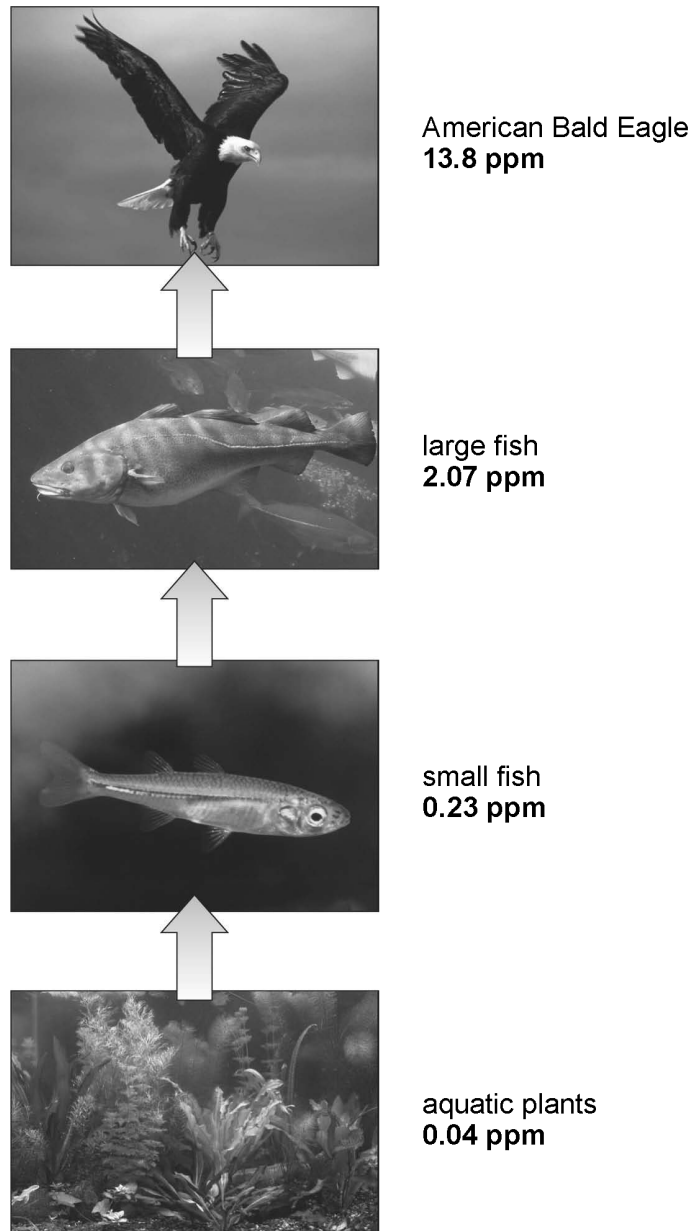
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- (b) Apart from the use of pesticides state **one other** method farmers use to increase crop yields. [1]

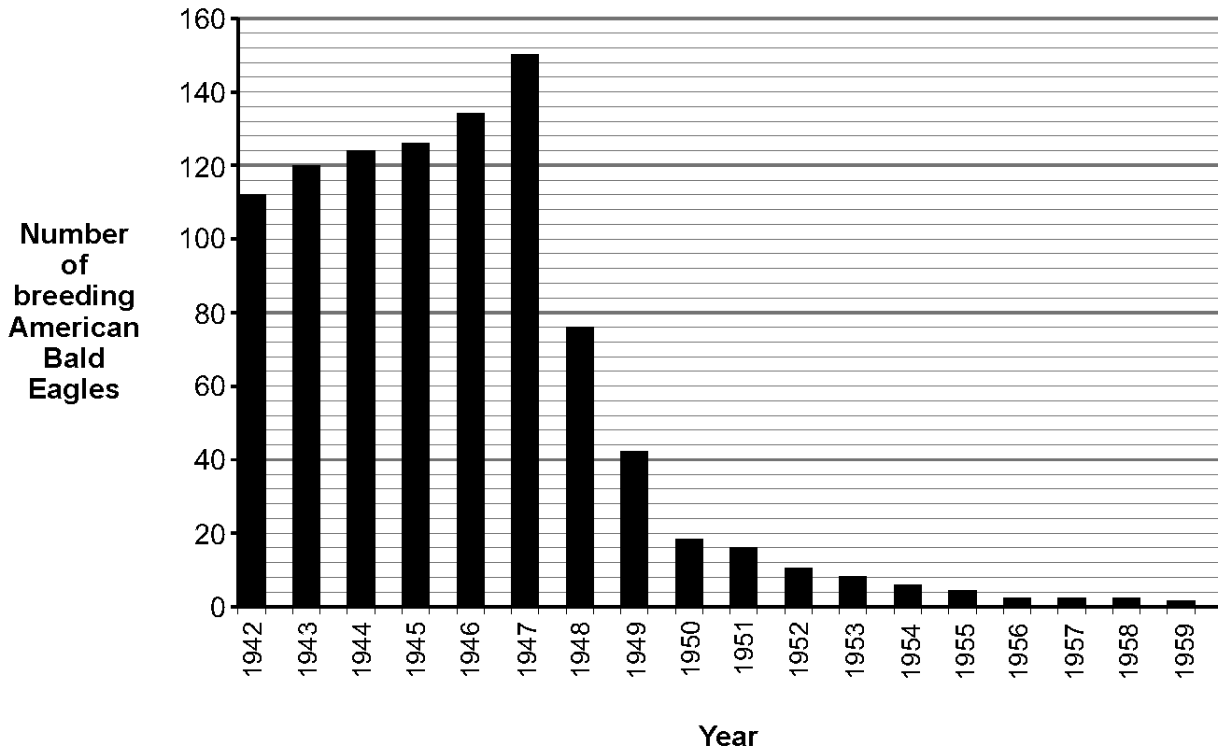
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- (c) DDT is a powerful insecticide which was extensively sprayed onto crops in the middle part of the twentieth century. Its use is now banned in many regions of the world because it resulted in the death of many top predators. One of the top predators affected was the American Bald Eagle (*Haliaeetus leucocephalus*) whose numbers in the USA dropped to only 834 in 1963.

The food chain below shows the concentration of DDT in ppm (parts per million) in the tissues of the organisms in a food chain.



The graph below shows the number of breeding American Bald Eagles in Florida between 1942 and 1959.



- (i) From the graph, suggest the year in which DDT was first used in Florida as an insecticide. [1]

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- (ii) Suggest why DDT is found in the aquatic plants if it is only sprayed onto crops grown on land. [1]

36.

A farmer whose land borders a lake decides to grow cereal crops sprayed with artificial fertiliser. Describe the probable environmental effects on the organisms in the lake. [6 QWC]

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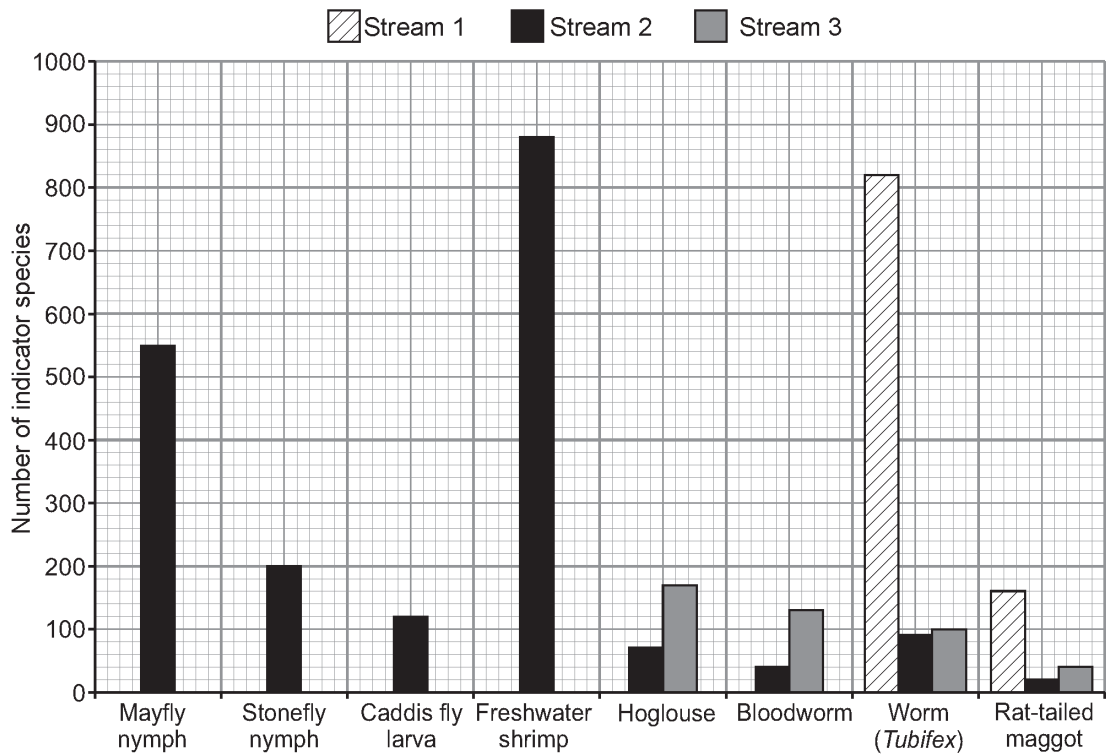
37.



Following flooding in parts of Wales in 2015, environmental scientists investigated nitrate pollution in three different streams. They counted the numbers of eight different indicator species in equal lengths of the three streams, on the same day. The indicator species they counted are shown in the chart below.

GROUP	INDICATOR SPECIES	POLLUTION LEVEL
A	 Mayfly nymph  Stonefly nymph	If you find these animals in your stream, then there is LITTLE OR NO POLLUTION
B	 Caddis fly larva  Freshwater shrimp	If you find these animals, but none from Group A, then there may be SLIGHT POLLUTION
C	 Hoglouse  Bloodworm	If you find these animals, but none from Groups A or B, then there is probably MEDIUM POLLUTION
D	 Worm (<i>Tubifex</i>)  Rat-tailed maggot	If you find these animals, but none from Groups A, B or C, then there is HIGH POLLUTION
E	No live animals found	If you find no animals at all, then there is VERY HIGH POLLUTION

Graph showing the number of indicator species found in each of the streams 1, 2 and 3



- (a) (i) Using the graph above and the chart on the opposite page state the pollution level in each of the three streams. [2]

stream 1

stream 2

stream 3

- (ii) Suggest **two** possible **sources** of nitrate pollution in streams. [2]

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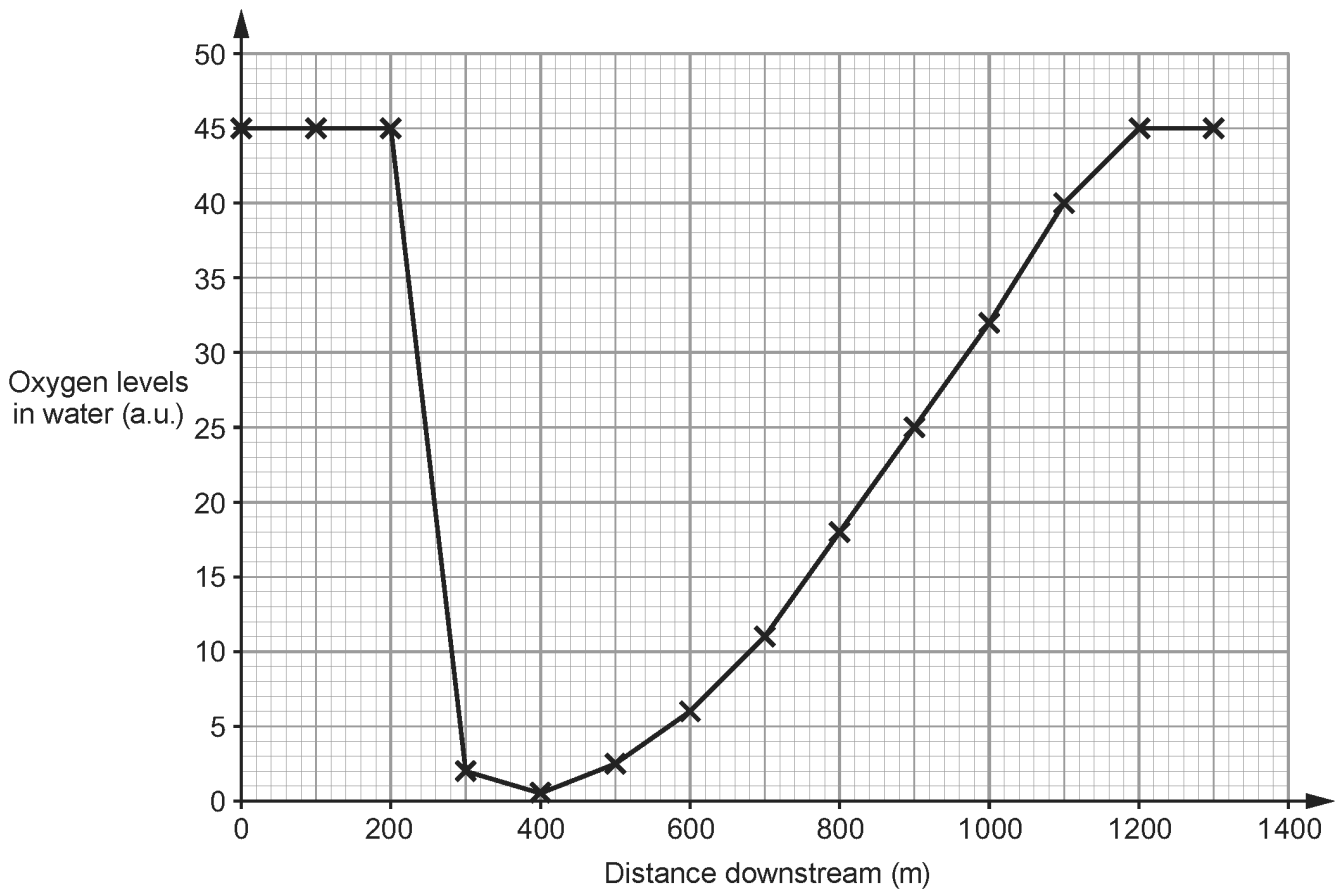
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- (b) Name **one** type of indicator species which could be used to assess levels of air pollution. [1]

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40.

The graph shows the oxygen levels in a slow-moving stream into which sewage has leaked.



- (a) (i) **Mark with an arrow** the point on the graph at which sewage leaked into the stream. [1]
- (ii) Explain why the oxygen levels drop sharply between 200 m and 300 m downstream. [2]

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- (b) The table below shows some organisms which are found in fresh water streams. It also indicates the level of tolerance these organisms have to various levels of pollution. The organisms are grouped according to tolerance.

group	organism	tolerance to water pollution
A	rat-tailed maggots	high
	blood worms	
	sludge worms	
B	fresh water shrimp	medium
	water lice	
C	mayfly nymphs	low
	dragonfly nymphs	
	caddis fly nymphs	

- (i) Suggest which group (A-C) would be most common between 300 and 500m downstream.

[1]

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- (ii) Suggest between which two points downstream would most mayfly nymphs be found.

[1]

between m and m

- (c) What term is given to organisms which scientists can use to identify polluted areas? [1]

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(a) (i) What is meant by the term indicator species?

[1]

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(b) Lichens can be used as indicators of air quality and are often found covering the bark of trees. The amount of tree bark covered with lichen is known as the percentage cover. In the photograph below the lichen is covering about 40% of the bark i.e. the percentage cover is 40%.

Lichen on the bark of a tree



The table below shows the pH of the bark of ash trees and the percentage (%) cover of a lichen which is very sensitive to air quality. The data were collected along a 19 mile line, starting from the centre of a large industrial city.

Distance from city centre (miles)	0	1.0	1.7	3.0	4.7	6.0	6.5	7.0	8.0	9.0	9.5	10.5	12.5	14.5	16.5	19.0
pH	3.2	3.4	3.4	3.5	3.4	3.6	3.6	3.7	3.6	3.9	4.4	4.4	4.3	4.3	4.5	4.5
% cover of lichen	0	0	0	0	0	0	0	0	1	12	23	25	54	57	66	66

Describe and explain the change in the percentage (%) cover of lichen as you move out of the city centre. [3]

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