WJEC (Eduqas) Biology GCSE
Topic 6.1 Levels of Organisation Within an Ecosystem
Questions by Topic

1. The Rose-bay willow-herb, *Epilobium angustifolium* is a plant that produces wind dispersed seeds.

The survival of this plant in its natural habitat was studied by counting the number of

- seeds found on the ground,
- seedlings,
- fully grown plants.

The counts were completed every 2 metres away from the parent population.

All counts were taken in the direction of the prevailing wind (direction in which the wind mainly blows).

The results are shown in the table:

distance from parent population (m)	seeds (per m^2)	seedlings (per m^2)	fully grown plants (per m^2)
2	22	20	0
4	30	25	0
6	31	30	0
8	28	25	1
10	25	20	2
12	18	15	3
14	9	9	5
16	8	5	5
18	4	3	3

(c) Explain why no fully grown plants are found within 6 m of the parent population. [2]

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2.

Scientists investigated how crop yields (mass of crops produced per m^2) vary when plants are grown at different densities in a field. The results are shown in the table below.

Density (number of plants per m^2)	Crop yield (kg per m^2)
1	20
5	85
10	92
15	90
20	90
25	80

(a) Which density gives the greatest crop yield? ..... plants per m^2 [1]

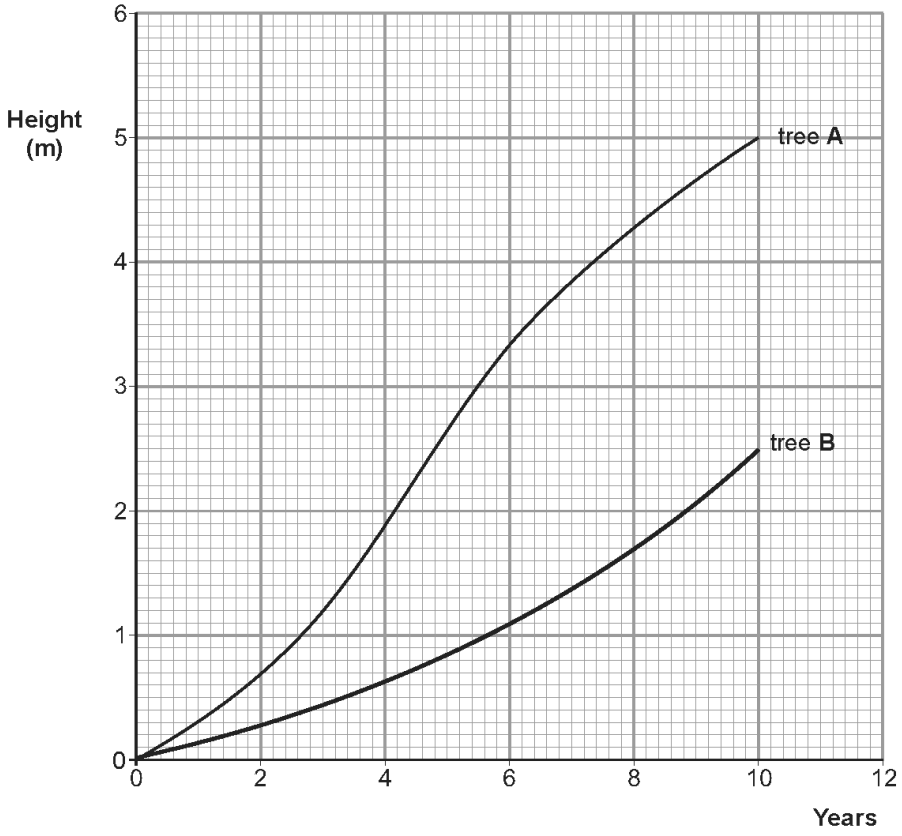
(c) Suggest **two** reasons why the yield per plant decreases as the number of plants per m^2 increases. [2]

1. .....

2. .....

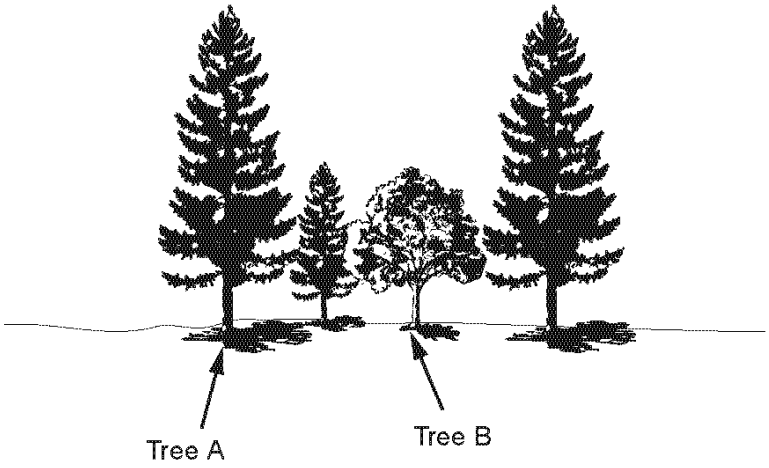
3.

The graph below shows the growth of two trees (**A** and **B**) during a period of 10 years.



(a) Give the difference in height between trees **A** and **B** at 10 years. [1]

(c) The trees were growing in a wood as shown in the diagram below.



Trees compete for resources.
Use the diagram above and your knowledge to give **three** resources for which trees compete. [3]

1 .....

2 .....

3 .....

(d) Suggest **one** reason, apart from competition for resources, for the difference in mean growth rate between the two trees. [1]

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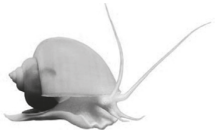
4. Some organisms living in a large lake and their total biomass in kg are shown below.

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]

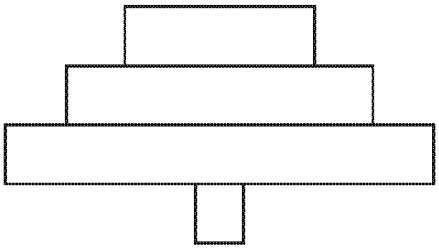
(iii) The pike in the lake are affected by a parasite, called a fish louse, which lives on their skin. There would be many of these parasites on each pike but their biomass would be less than the biomass of the pike.

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]



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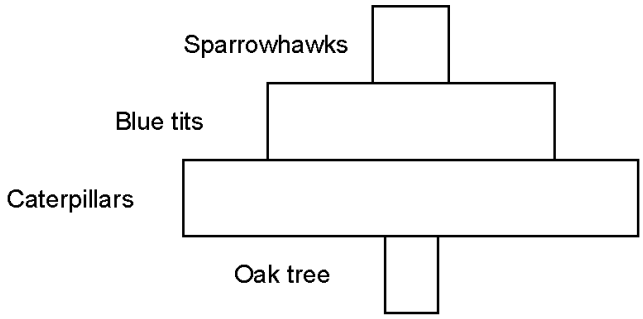
5. The diagram below shows the pyramid of numbers for a food chain found in a small wood.



(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]

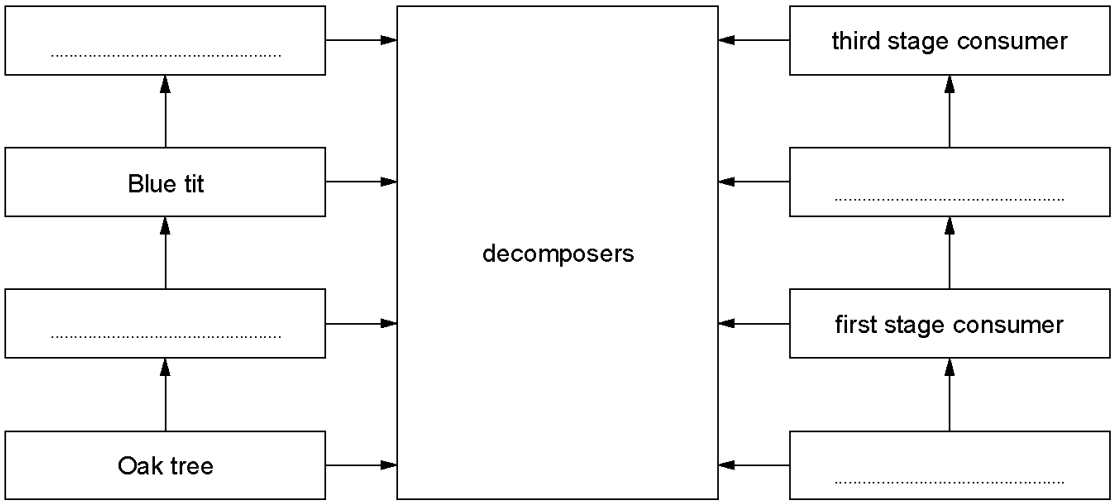
1 17 3456 2

(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]



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	300000	350.00	20000
primary consumers	grasshoppers	25600	5.12	1353
	seed-eating birds	45	1.08	2567
	field mouse	42	1.05	1941
secondary consumer	kestrel (bird of prey)	2	0.34	412

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

7.

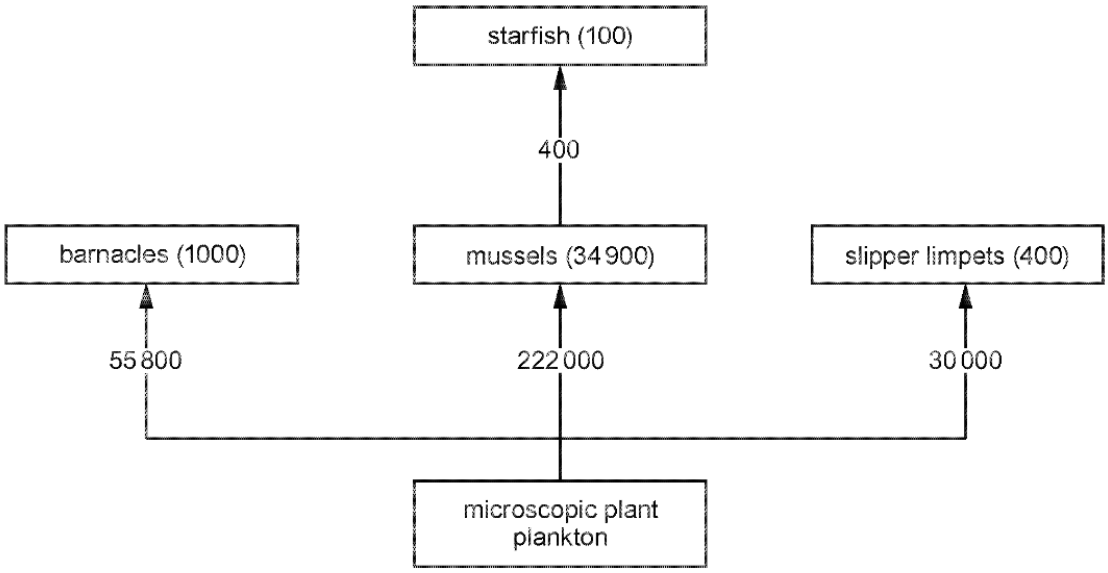
Concerns over the effects that the insecticide DDT was having on top predators in the 1960s led scientists to monitor lakes and rivers throughout the UK. The table below shows some of the data obtained from a small lake during the monitoring.

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

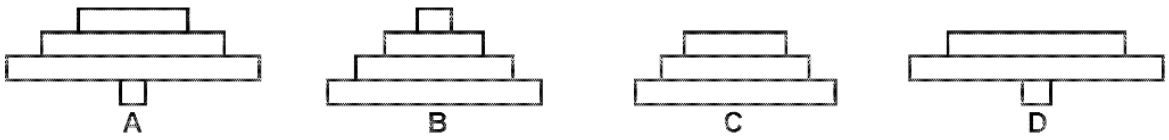
(b) In the space below, **draw a labelled pyramid of biomass** for the food chain containing organisms named in the table above. [2]

8.

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 m^2 per year. Numbers in brackets show the energy that becomes part of the biomass of the organisms in kJ per m^2 per year.



(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]

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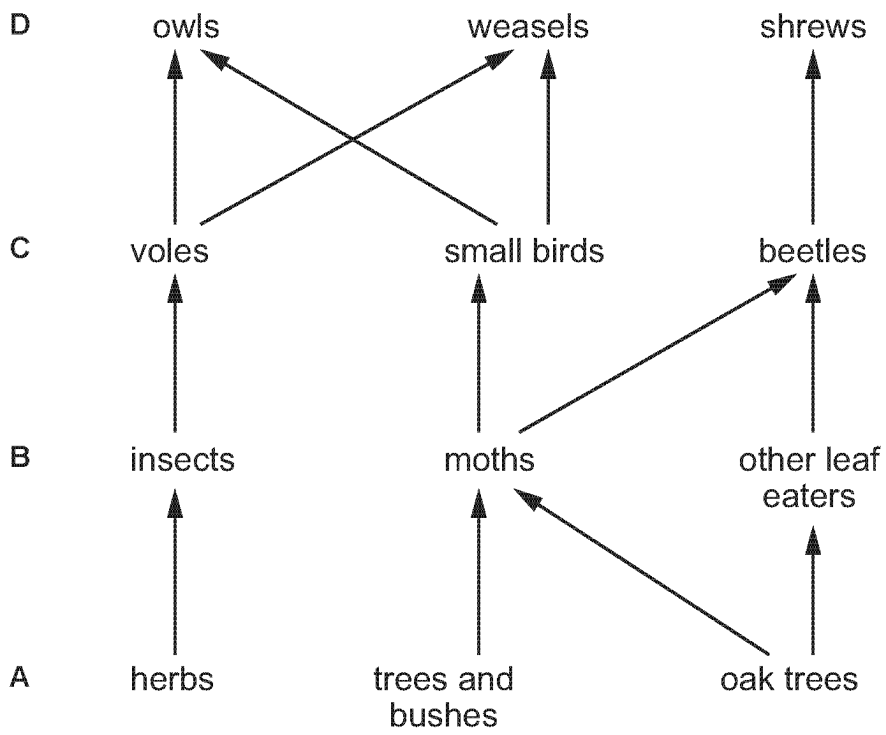
9. The diagram below shows a food web for a woodland.



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

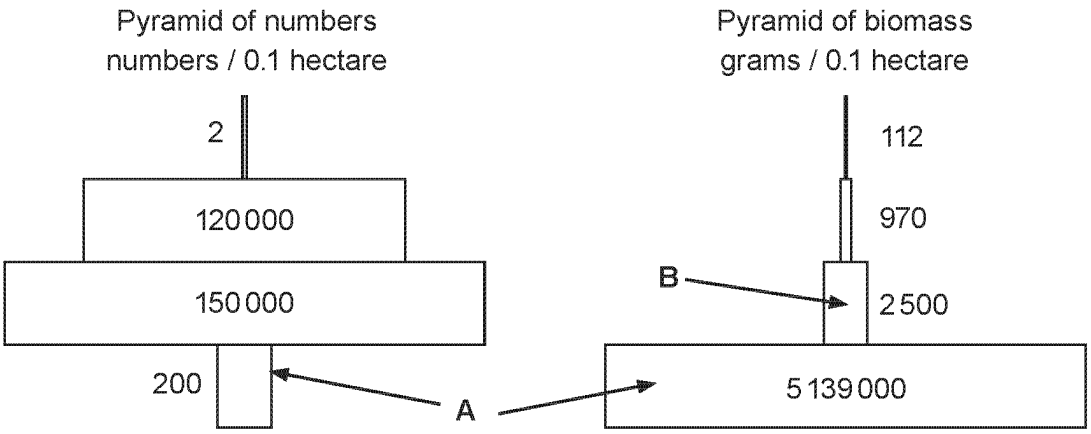
A .....

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 = ... %

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

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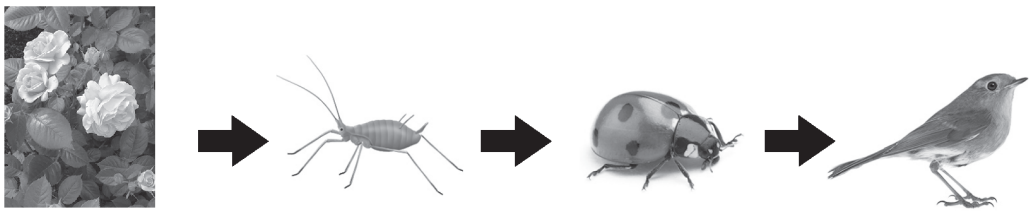
10. The diagram shows a garden food chain.



(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]

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(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]

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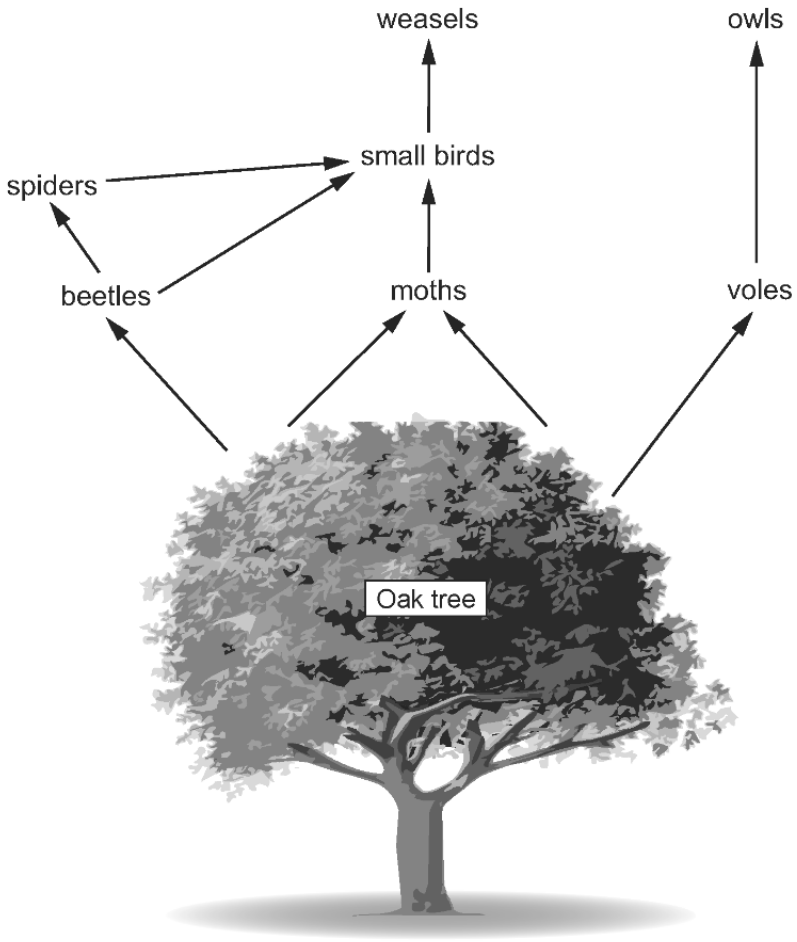
11. The diagram below shows a food web.



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

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(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.

12.

The photograph shows a hedgehog.

(a) Hedgehogs are carnivores. What does the term *carnivore* mean? [1]

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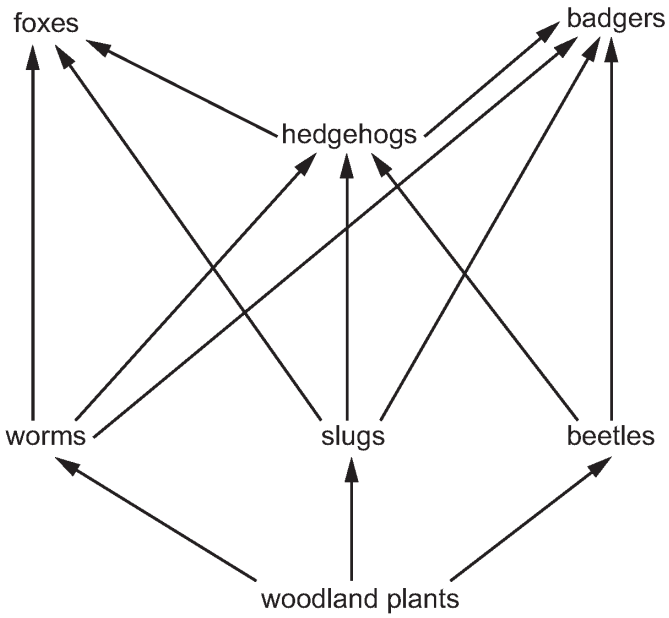
(b) The diagram below shows a woodland food web that includes hedgehogs.



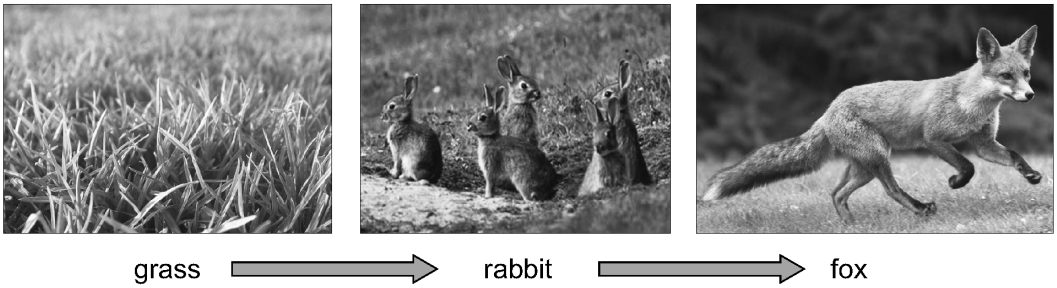
Use information in the food web opposite **and** your own knowledge to answer the following question.

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

13. The diagram shows a grassland food chain.

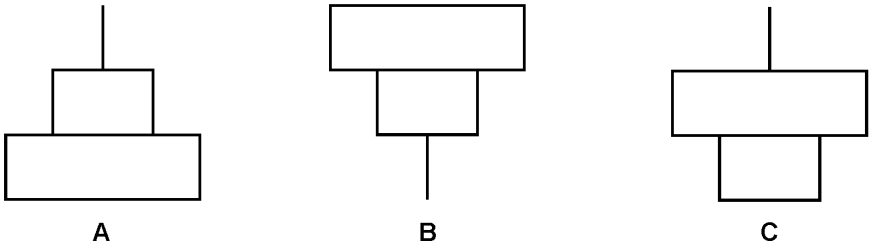


(a) Which **one** of the following words describes the rabbits? [1]

Underline the correct answer.

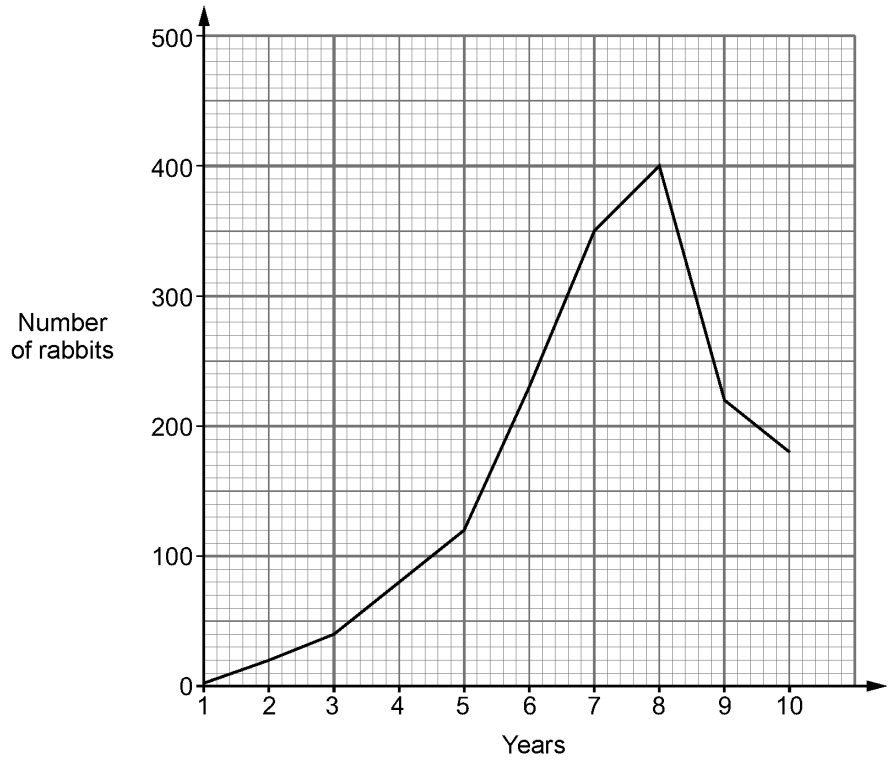
Rabbits are: producers herbivores carnivores

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



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]

.....

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

Answer .....

(d) Rhian said 'the number of rabbits has fallen because they don't have enough space'.

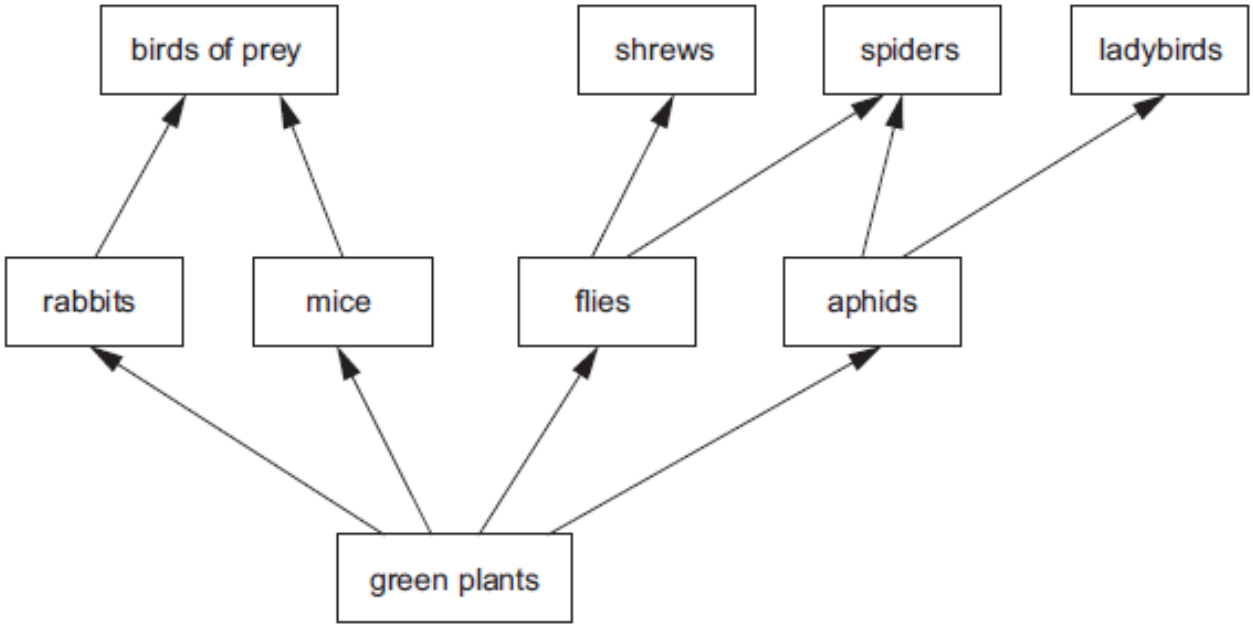
Apart from lack of space, suggest **three** other reasons that might cause the number of rabbits on the island to decrease. [3]

1. .....

2. .....

3. .....

14. 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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15. 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]

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(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]

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(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

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.

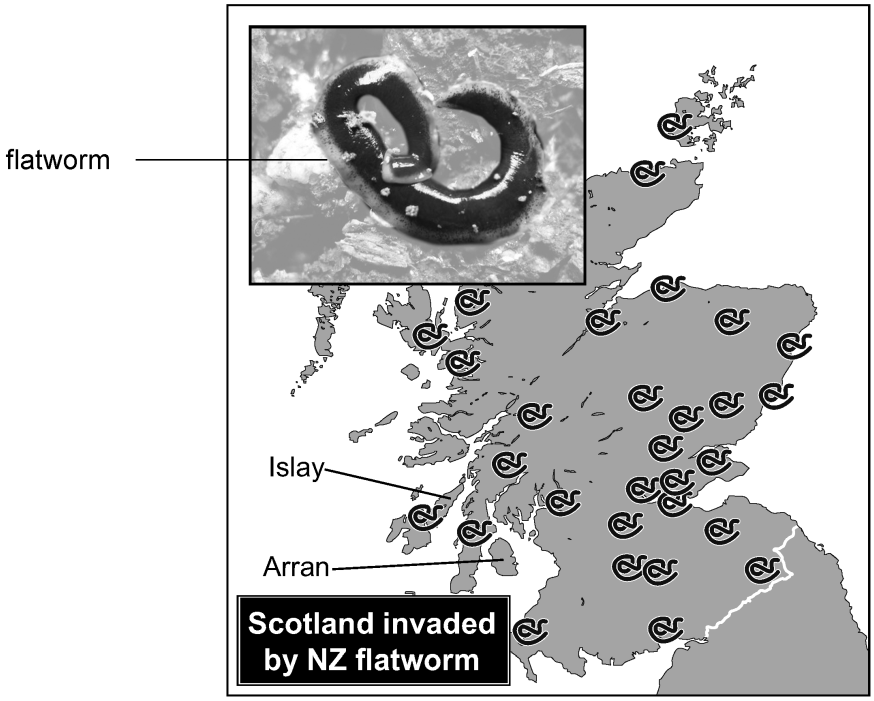
	number of breeding pairs of waders			
	Islay		Arran	
wader	1983	2000	1983	2000
Lapwing	1869	1287	1104	1364
Redshank	1288	760	486	733
Dunlin	2016	884	803	558
Snipe	655	280	172	154

(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.



- 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]

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(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]

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

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17.

A population of sheep lives on the Scottish island of St. Kilda.
The photograph below shows a sheep.

(c) Sheep are herbivores.

What does the term *herbivore* mean? [1]

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(d) The sheep on the island are either pale or dark in colour.

The table below gives the percentage (%) of dark sheep on St. Kilda between 1985 and 2005.

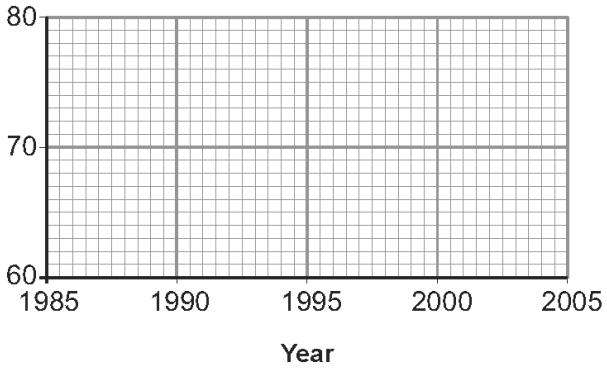
Year	Percentage (%) of dark sheep
1985	76
1990	74
1995	71
2000	70
2005	69

(i) Using the data above, plot a line graph on the grid below by:

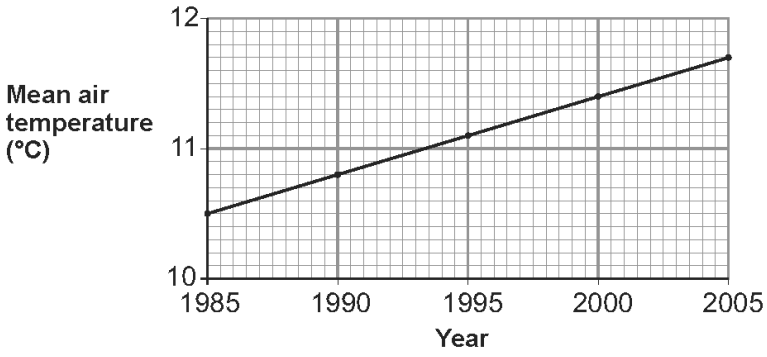
I. Labelling the vertical axis. [1]

II. Plotting the points. [2]

III. Joining the points with a ruler. [1]



(ii) The graph below shows the mean air temperature on the island over the same period.



Some scientists have the opinion that the change in the percentage of dark sheep on the island is due to a change in the mean air temperature.

I. Using **both** of the graphs opposite, describe the evidence that supports the scientists' opinion. [1]

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II. It is not possible to be sure that the change in the percentage of dark sheep on the island is due to the change in the mean air temperature.

State **two** *other* factors that could cause the change in the percentage of dark sheep. [2]

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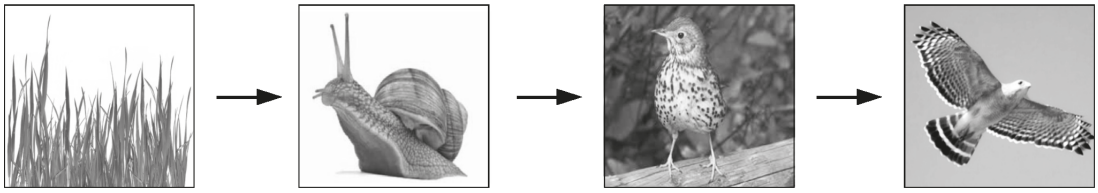
18. The photographs below show a food chain.



grass → snail → thrush → hawk

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

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(b) Complete the following sentence:

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