Q1. 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.

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(4)

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

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(3)
(Total 7 marks)

Q2. Read the passage.

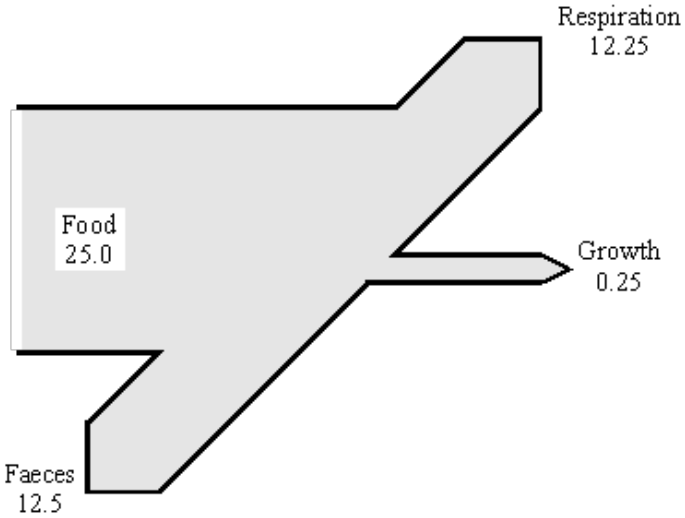
Glutton up a gum tree

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."

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 .....

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2 .....

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3 .....

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(3)
(Total 5 marks)

Q3. Read the passage.

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.

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(Total 4 marks)

Q4. The gemsbok is a large herbivore that lives in herds in desert areas of South Africa. Gemsboks feed on plants that are adapted to living in dry conditions. There are not many rivers, lakes or ponds that can provide drinking water for the animals. The desert areas are hot during the day but cool at night. As the air cools at night it becomes moist, and the plants absorb the moisture.

(a) A few lions live in the desert areas. They hunt and feed on the gemsboks.

Use information from the drawing of the gemsbok to suggest **two** ways in which it could avoid being killed by lions.

1 .....

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2 .....

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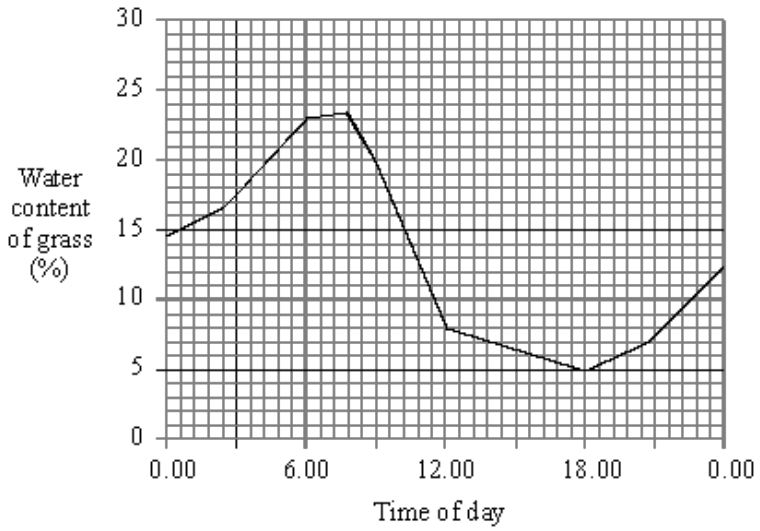
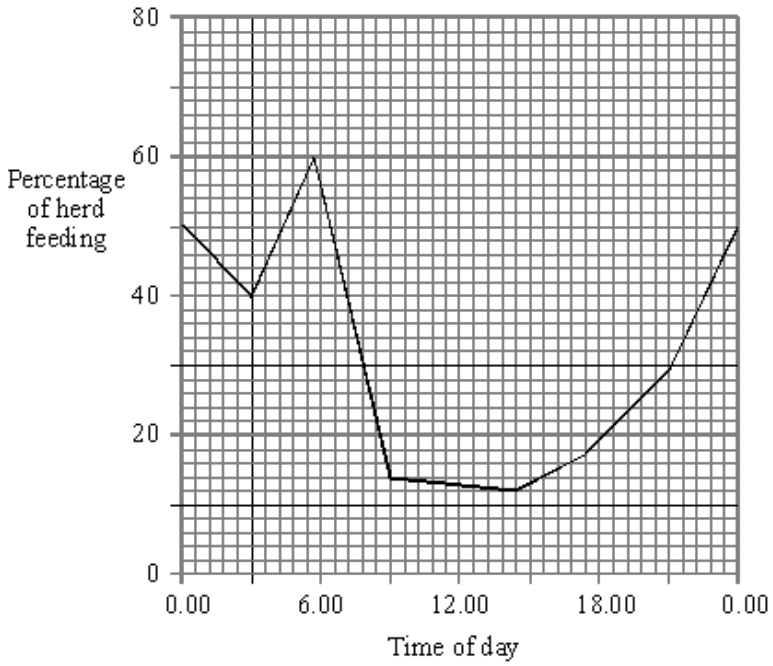
(2)

(b) The graphs show the water content of the desert grass and the times of day that the gemsboks feed.





(i) Describe how the water content of the grass changes during the day.

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(1)

(ii) Suggest why the water content of the grass changes.

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(1)

(c) (i) Between which times of day are more than 25% of the herd feeding?

..... and .....

(1)

(ii) Suggest an advantage to the gemsbok of feeding mainly at these times.

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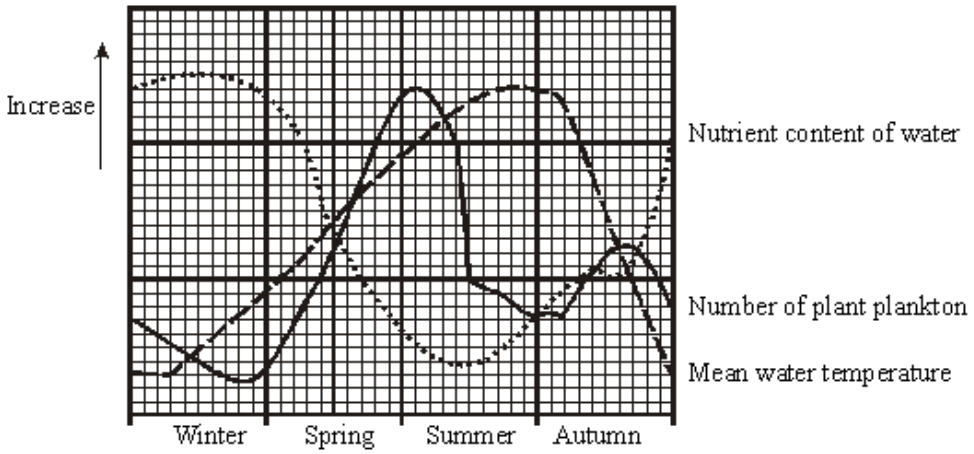
(2)
(Total 7 marks)

Q5. Plant plankton are aquatic microscopic organisms that photosynthesise. The graph shows the numbers of plant plankton in the North Sea at different times of the year.



Use the data and your knowledge of photosynthesis and growth to explain:

(a) why numbers of plant plankton were low in winter but increased rapidly during the spring,

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(3)

(b) the reduction in numbers of plant plankton in the early summer.

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(1)
(Total 4 marks)

Q6. In just a decade the population of the African elephant dropped from 1.3 million in 1979 to 625 000 in 1989. The ivory trade was a major cause of this. The international trade in ivory was banned in 1989 in an attempt to arrest the fall in elephant numbers. The ban does not, however, have universal support, particularly amongst African countries. The extracts below give some opinions about the ban on killing elephants.

Extract 1

Massive publicity for the plight of the elephant in the US and Europe resulted in people refusing to buy ivory products. As a result the world price of ivory fell. Poaching levels fell noticeably in five out of six countries studied since the introduction of the ban.

Extract 2

If the case for wildlife is justified on economic grounds alone, then protected areas could give way to many more profitable forms of land use. Wildlife, and especially an animal as intelligent as the elephant, has an absolute right to life and a value that cannot be measured solely in economic terms.

Extract 3

South African governments consider wildlife a natural resource which must earn its keep alongside other competing forms of land use both by bringing in tourists and from the killing of excess animals for food and other animal products. Zimbabwe for example keeps elephant numbers to a level which can be supported by the vegetation available. Before the ban, ivory and hide were exported to gain valuable foreign currency. The planned use of wildlife for the benefit of local people and as a means of conservation for elephants is of great importance in that country.

Extract 4

Banning the trade in ivory, these countries argue, removes one of the main economic justifications for giving over large areas of land to wildlife and has resulted in heavy financial losses for those countries which conserve elephants. These countries are asking that they should again be allowed to trade in ivory and hides to provide the funding to conserve elephants.

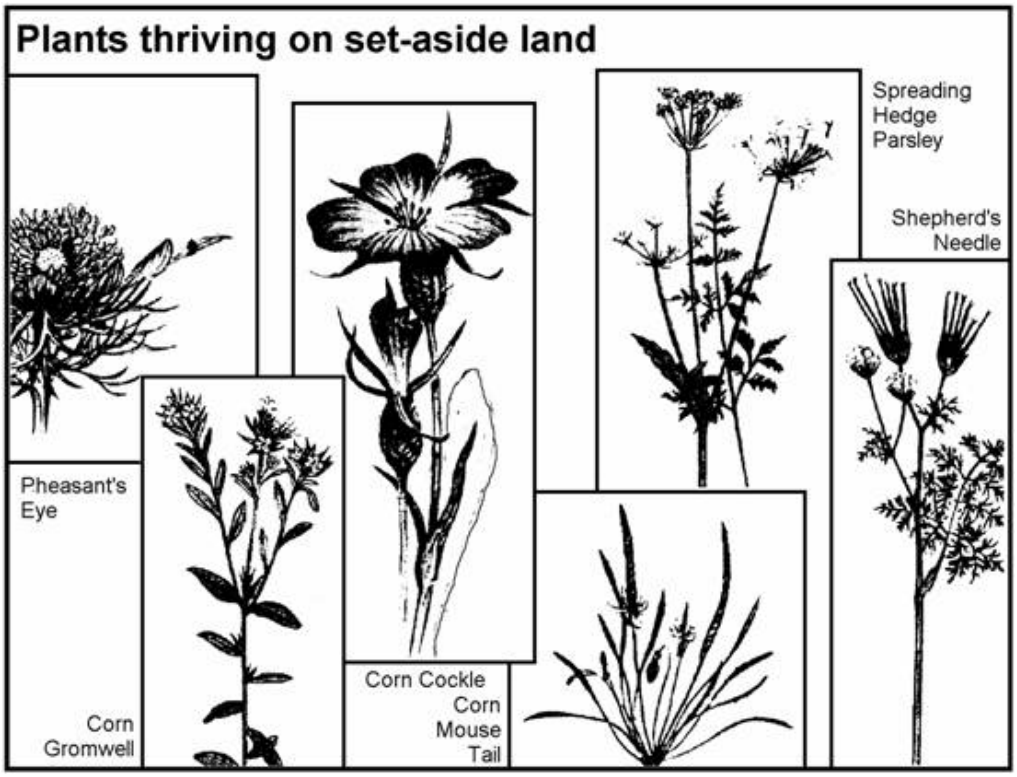
Extract 5

Arguments about the need to preserve elephants for their intelligence or for their appearance carry little weight in a rural population faced with widespread famine. In the long run it appears that African wildlife will have to benefit those who live alongside it, and pay its way if governments are to invest in it.

Read the extracts then state whether you think that the ban on ivory and hide trading should be lifted. Justify your decision by referring to all the extracts.

(Total 7 marks)

Q7.



The drawings and text for this question are based on an article from The Independent newspaper.

Some of Britain's rarest wild flowers are likely to make a come-back thanks to an EC set-aside regime in which 15 per cent of arable land has been taken out of production.

As a result of this set-aside, shepherd's needle, pheasant's eye, corn gromwell, corn cockle, spreading hedge parsley and corn mouse tail are now thriving once again. They were once common in and around cereal fields and were even regarded as weeds, but were swept to near extinction by the intensification of agriculture after the Second World War. Their small, pale flowers are hardly seen. These plants cannot compete in fields where modern cereal crops are cultivated. Nor, however, do they flourish in semi-natural or wild habitats where nature is left to its own devices. They need farmland which is lightly tilled and cut once a year.

Dr Nick Sotherton, lowland research manager with the Game Conservancy Council, says that these species will flourish under the new rotational set-aside regime, in which farmers are compensated for taking land out of production in an attempt to end crop surpluses.

EC agriculture ministers are meeting to decide how much land should be used for rotational set-aside – in which a field is taken out of production for just one year before being replanted – and how much should be set-aside permanently. The ultimate set-aside is a wood, and Britain is seeking a forestry option.

The Game Conservancy Council says that the rotational scheme can benefit ground nesting birds as well as rare flowers that will not be helped by longer-term set-aside. But Richard Knight of the Wildlife Advisory Group, says "Non-rotational is better because it gives flora and fauna a chance to get well established".

"Intensification of agriculture" has led to the creation of artificial ecosystems.

(a) Explain how the creation of artificial ecosystems may have led to the near-extinction of the plants seen in the picture above.

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(4)

(b) What would you recommend to ministers meeting to decide a policy involving rotational set-aside and permanent set-aside? Explain the reasons for your answer.

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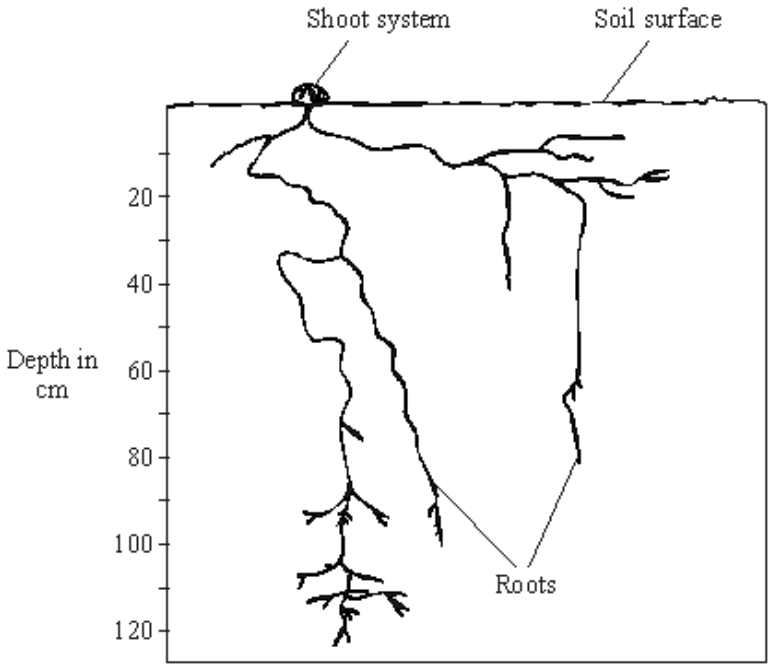
(4)
(Total 8 marks)

Q8. The diagram shows the desert plant, *Fredolia.*



Describe and explain **three** adaptations of *Fredolia,* which you can see in the diagram, that help it to survive in dry conditions.

1 .....

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2 .....

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3 .....

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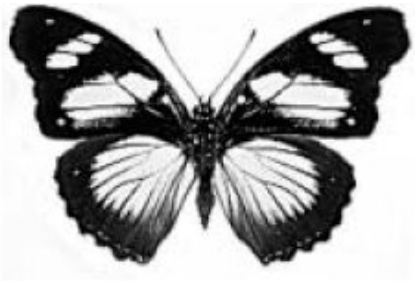
(Total 3 marks)

Q9. The drawings show two different species of butterfly.

Amauris



Hypolimnas

- Both species can be eaten by most birds.
- *Amauris* has a foul taste which birds do not like, so birds have learned not to prey on it.
- *Hypolimnas* does **not** have a foul taste but most birds do not prey on it.

(a) Suggest why most birds do **not** prey on *Hypolimnas*.

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(2)

(b) Suggest an explanation, in terms of natural selection, for the markings on the wings of *Hypolimnas*.

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(3)
(Total 5 marks)

Q10. The photograph shows a sand gazelle.

The sand gazelle lives in the Arabian Desert where temperatures often reach 45 °C.

(a) The sand gazelle feeds only at dawn and at dusk. At other times it stays in the shade.

Suggest how this helps the animal to conserve water.

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(2)

(b) During the dry season, the sand gazelle's liver and heart shrink in size. This reduces the amount of oxygen that the body needs.

Suggest how needing less oxygen helps the animal to conserve water.

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(2)
(Total 4 marks)

Q11. (a) Explain, as fully as you can, how natural selection leads to evolution.

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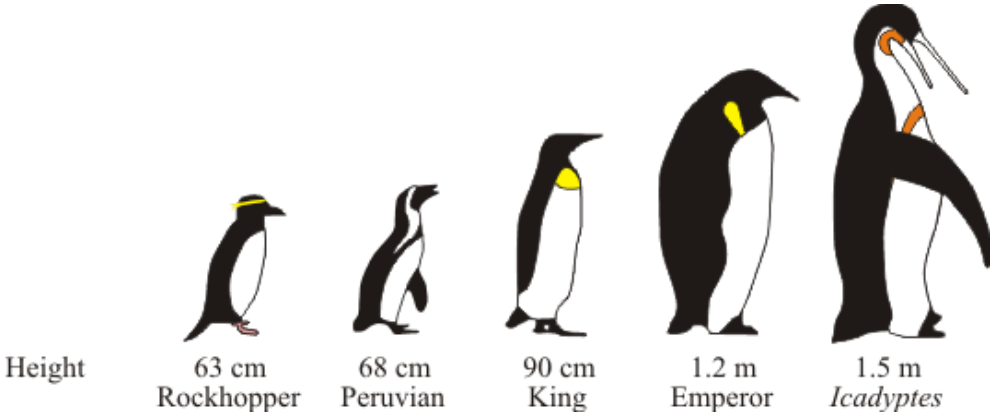
(3)

(b) Most penguins live in cold climates. The modern penguin best adapted for cold conditions is the emperor penguin.

Scientists have found fossils of a 'giant' penguin which they have called *Icadyptes*.

The diagram shows how the size of modern penguins compares with *Icadyptes*.



The scientists were surprised to discover that *Icadyptes* lived in warm seas at a time when the Earth's climate was much warmer than it is now.

Explain why the scientists were surprised that *Icadyptes* lived in warm seas.

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(2)
(Total 5 marks)

Q12. Squirrels live in woodland.

Table 1 shows:

- the total area of England, Scotland and Wales
- the area of different types of woodland in these countries.

Table 1

Country	Total area of country in thousands of km^2	Area of woodland in thousands of km^2		
		Coniferous woodland	Broadleaf woodland	Total
England	130	3.6	7.8	11.4
Scotland	79	10.4	3.0	13.4
Wales	21	1.9	0.9	2.8

(a) Look at the data for the three countries. Estimate which country has the greatest proportion of its area suitable as a habitat for squirrels.

Support your answer with relevant figures.

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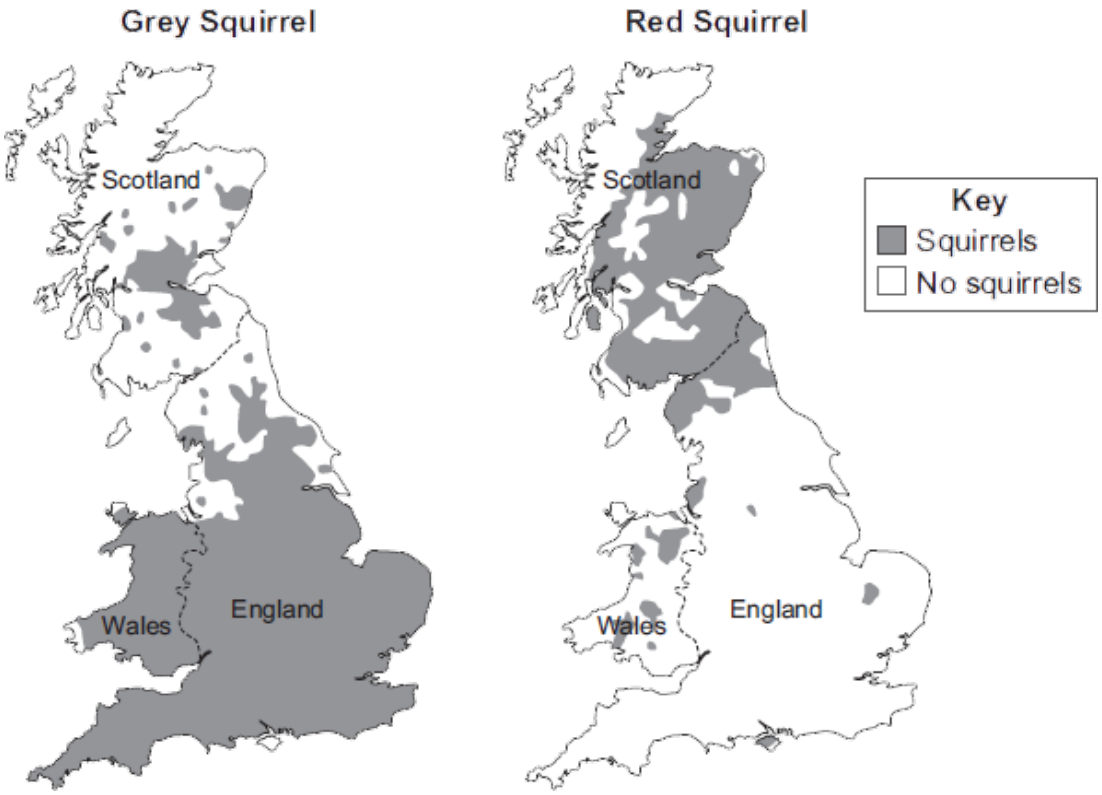
(2)

(b) The maps show the distribution of grey squirrels and red squirrels in England, Scotland and Wales.



Scientists suggested that the distribution of grey squirrels and red squirrels is linked to the type of trees in woodlands.

(i) The information for England and Scotland supports this suggestion.

How?

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(1)

(ii) Give **one** piece of evidence that contradicts this suggestion.

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(1)

(c) Red squirrels are native to the UK.
Grey squirrels were introduced to the UK from the USA over 100 years ago.

Table 2 gives information about the two types of squirrel.

Table 2

	Grey squirrel	**Red squirrel**
Population in UK	2.5 million	140 000
Main food types	Seeds, nuts, tree bark, birds' eggs, young birds	Cones from coniferous trees, nuts, tree bark, berries
Health	Can become immune to parapox virus	Cannot become immune to parapox virus
Reproduction	Up to 9 young, twice a year	Up to 6 young, twice a year
Survival rate of young in mixed populations	41 %	14 %
Length of life	2 – 4 years	Up to 7 years

In most parts of the UK the population of grey squirrels is increasing, but the population of red squirrels is decreasing.

Suggest why.

Use information from **Table 2**.

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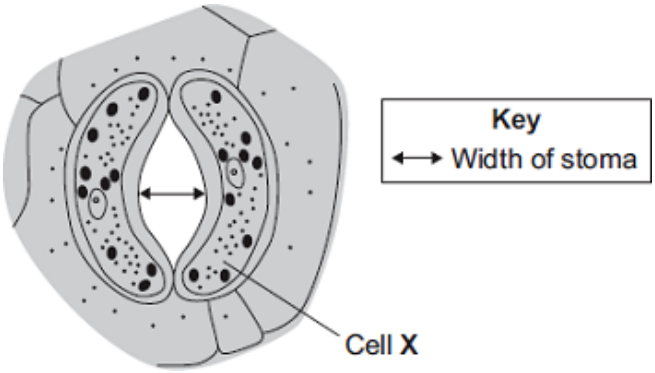
(3)
(Total 7 marks)

Q13. Plant leaves have many stomata.
The diagram shows a stoma.



(a) Name cell **X** . ……..

(1)

(b) The table shows the mean widths of the stomata at different times of the day for two different species of plant.
Species **A** grows in hot, dry deserts.
Species **B** grows in the UK.

	Time of day in hours	Mean width of stomata as a percentage of their maximum width	
		Species A	Species B
Dark	0	95	5
	2	86	5
	4	52	6
Light	6	6	40
	8	4	92
	10	2	98
	12	1	100
	14	0	100
	16	1	96
	18	5	54
Dark	20	86	6
	22	93	5
	24	95	5

The data in the table show that species **A** is better adapted than species **B** to living in hot, dry deserts.

Explain how.

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(4)
(Total 5 marks)

Q14. The drawings show two different species of butterfly.

Amauris

Hypolimnas

- Both species can be eaten by most birds.
- *Amauris* has an unpleasant taste which birds do **not** like, so birds have learned **not** to prey on it.
- *Hypolimnas* does **not** have an unpleasant taste but most birds do **not** prey on it.

(a) Suggest why most birds do **not** prey on *Hypolimnas*.

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(2)

(b) Suggest an explanation, in terms of natural selection, for the markings on the wings of *Hypolimnas*.

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(3)
(Total 5 marks)

Q15. On a rocky shore, when the tide goes in and out, organisms are exposed to the air for different amounts of time.

(a) On hot, windy days when the tide is out the concentration of the salt solution in rock pools may become very high.

What term is used to describe organisms that can survive in severe conditions such as very high concentrations of salt solution?

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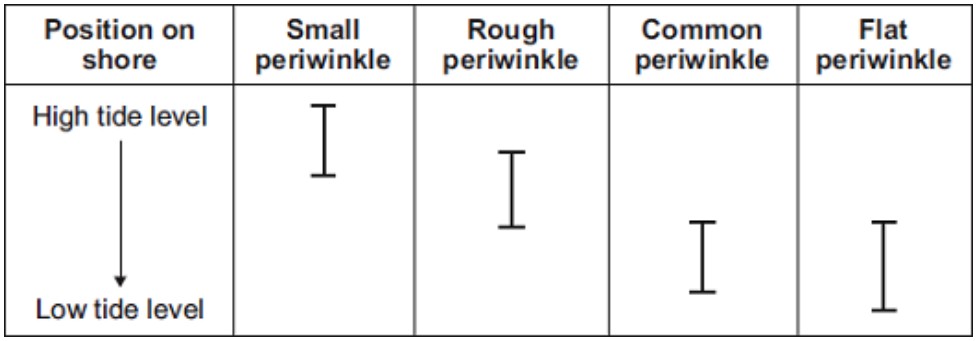
(1)

(b) Periwinkles are types of snail.
Students surveyed the different types of periwinkle living on a rocky shore.

The diagram shows the results of the students' survey.
The highest position that the sea water reaches on the shore is called the high tide level.
Each bar represents the range of habitats for each type of periwinkle.



(i) Which **two** types of periwinkle are likely to compete with each other to the greatest extent?

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(1)

(ii) Explain your answer to part (b)(i).

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(1)

(iii) The small periwinkle can survive much nearer to the high tide level than the flat periwinkle.

Suggest **two** reasons why the flat periwinkle cannot survive near to the high tide level.

1.....

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2.....

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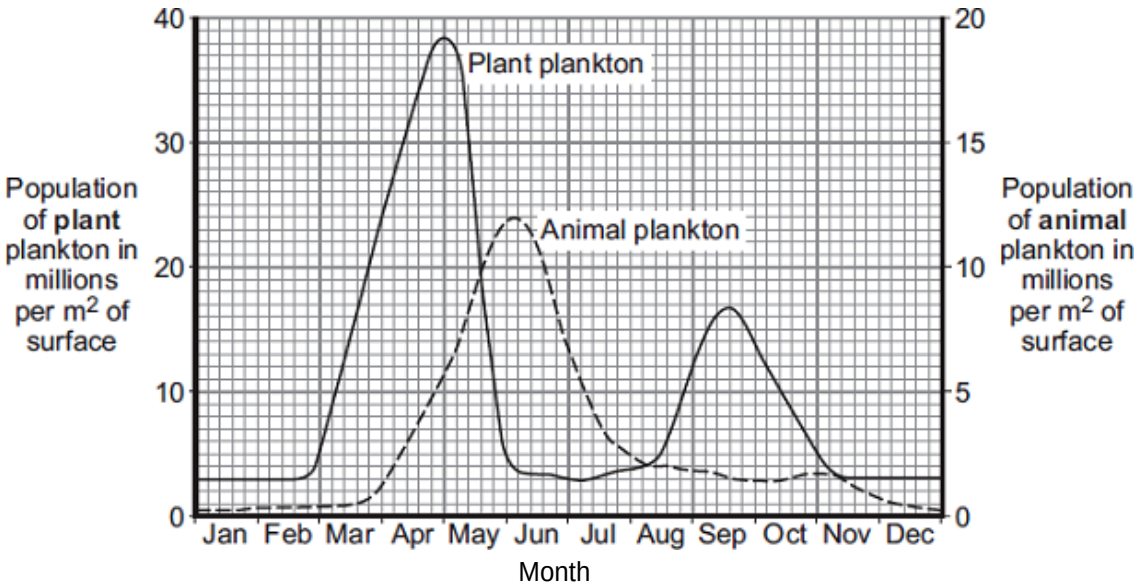
(2)
(Total 5 marks)

Q16. Plankton live in the sea.
Animal plankton eat plant plankton.

Graph 1 shows how the populations of the plankton change through the year in the seas around the UK.

Graph 1

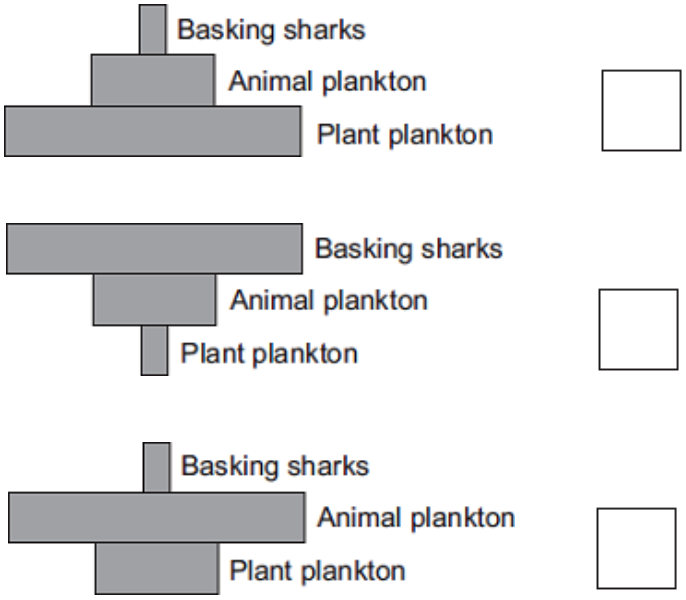


(a) Basking sharks eat animal plankton. Basking sharks grow up to 8 metres long.

Look at the diagram and **Graph 1**.

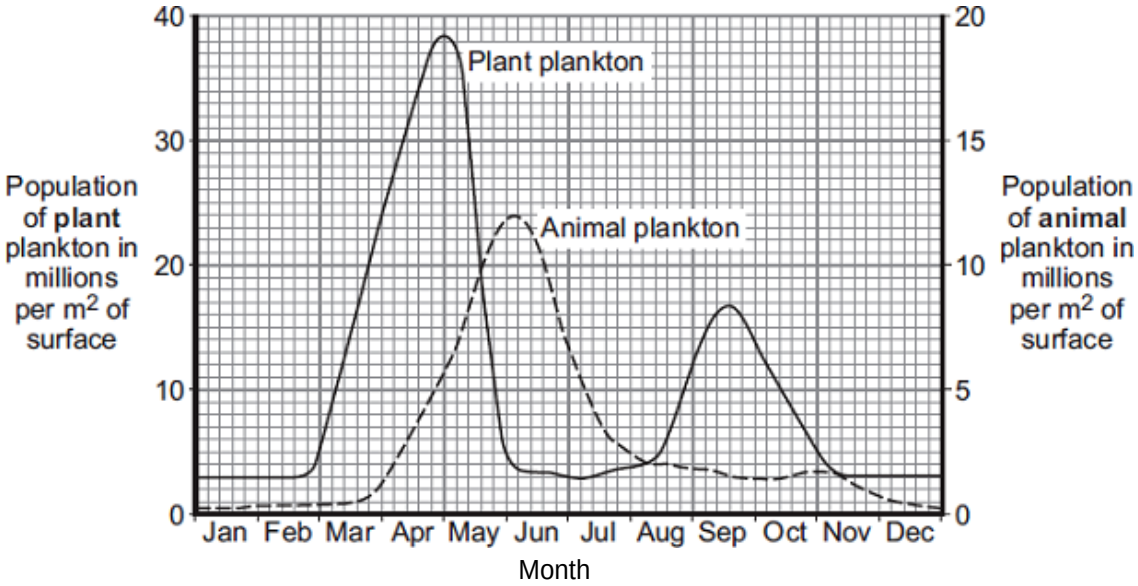
Which is the correct shape for the pyramid of biomass to show the relationship between plant plankton, animal plankton and basking sharks, in June?

Tick (✓) **one** box.



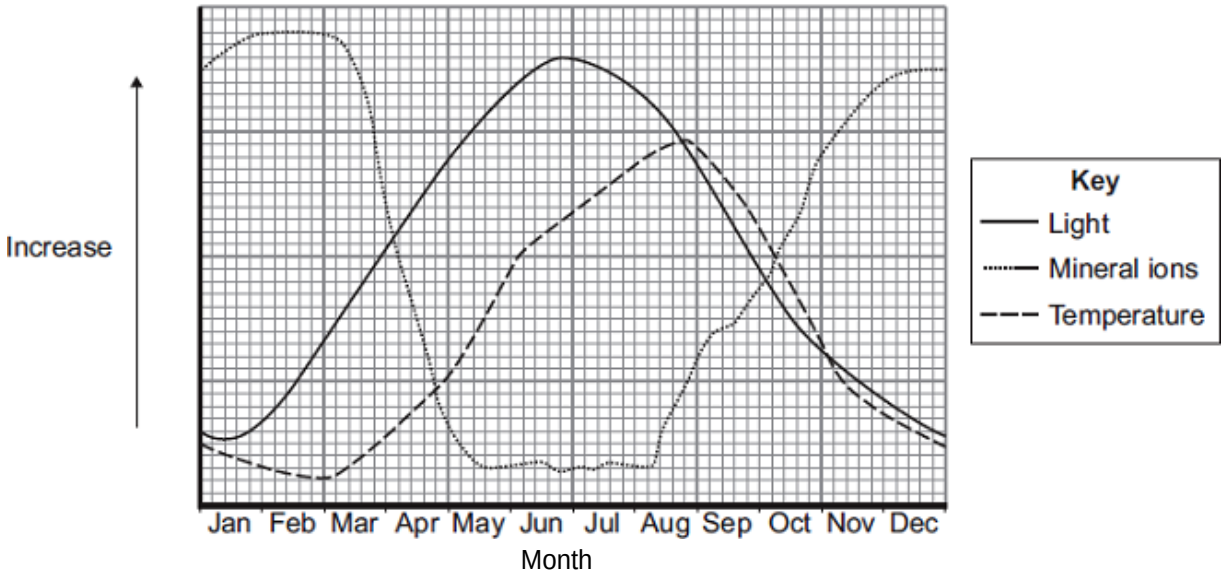
(1)

Graph 1 is repeated here to help you answer the following questions.



Graph 2 shows changes in some of the conditions in the upper layers of the sea around the UK.

Graph 2



(b) The population of plant plankton increases between February and April.

Suggest **one** reason for the increase.

Explain your answer.

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(2)

(c) The population of animal plankton changes between April and July.

Suggest explanations for the changes.

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(2)

(d) The concentration of mineral ions changes between February and December.

Suggest explanations for the changes.

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(3)
(Total 8 marks)