



## Exampro GCSE Biology

B1 Chapter 4 Adaptation  
Higher tier

Name:

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Class:

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Author:

Date:

Time: 66

Marks: 66

Comments:

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**Q1.** 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.

Position on shore	Small periwinkle	Rough periwinkle	Common periwinkle	Flat periwinkle
High tide level  Low tide level				

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

.....

(1)

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

.....

.....

(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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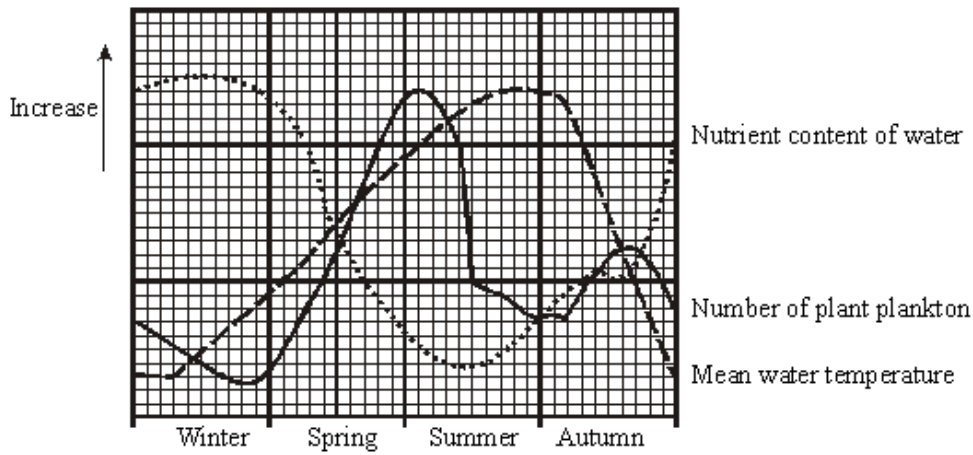
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(2)  
(Total 5 marks)

**Q2.** 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.

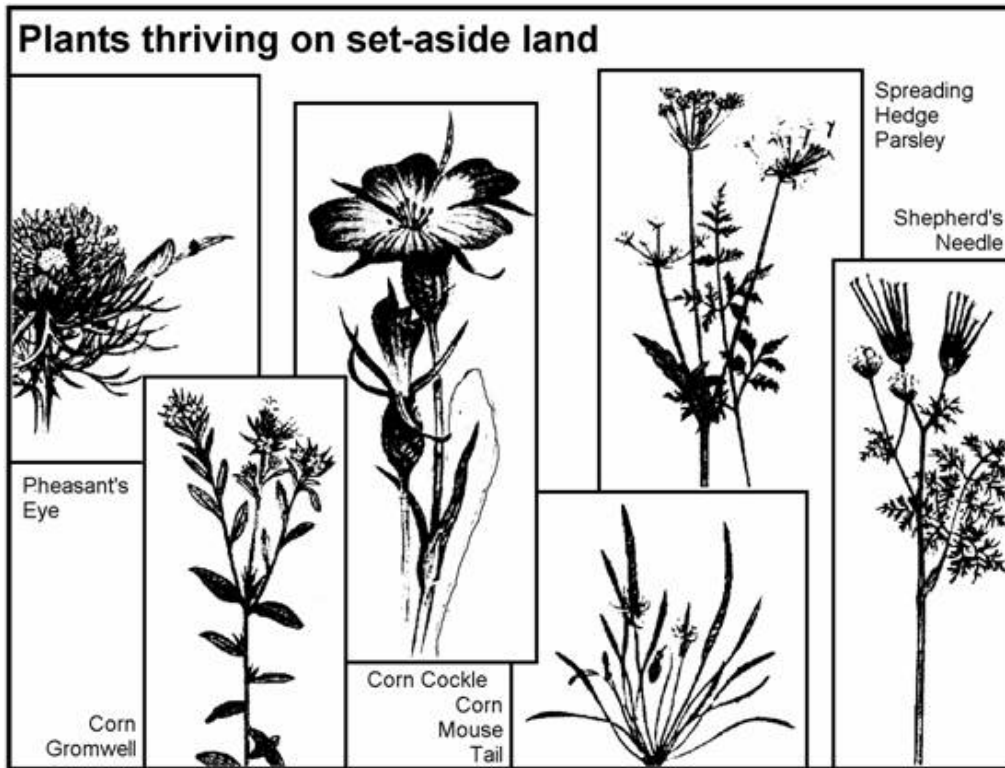
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(1)  
(Total 4 marks)



Q3.

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)**

- Q4.** 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.

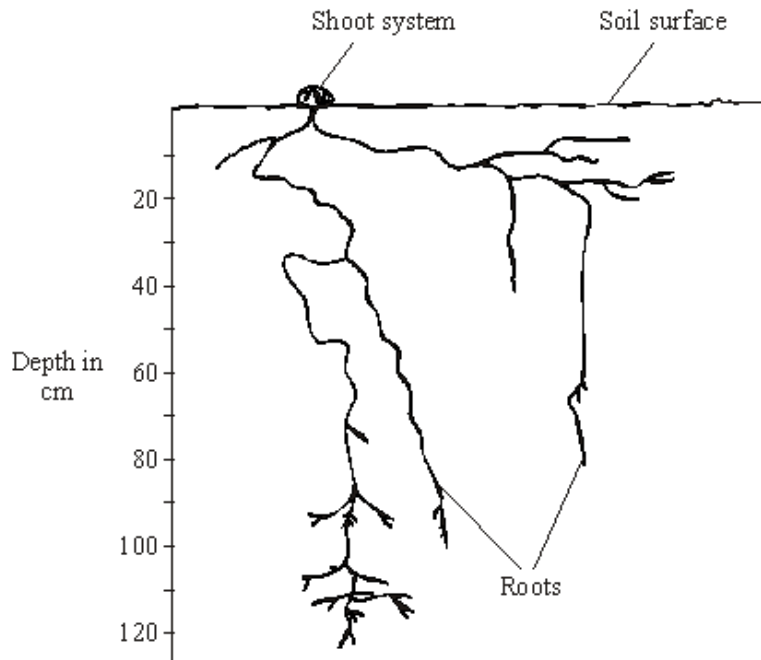
### Extract 5

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)

Q5. 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.

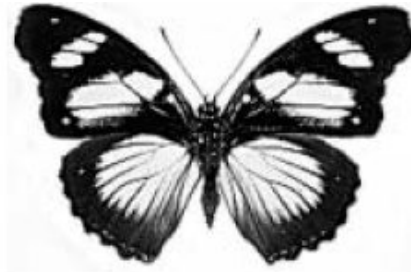
- 1 .....
- .....
- 2 .....
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- 3 .....
- .....

(Total 3 marks)

Q6. 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)

**Q7.** 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)

**Q8.** (a) Explain, as fully as you can, how natural selection leads to evolution.

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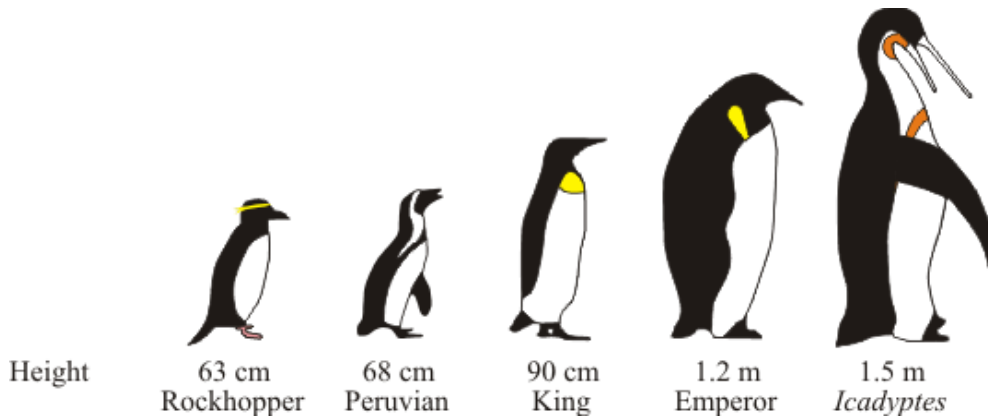
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(3)

(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)

**Q9.** 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)

**Q10.** 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 <sup>2</sup>	Area of woodland in thousands of km <sup>2</sup>		
		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.

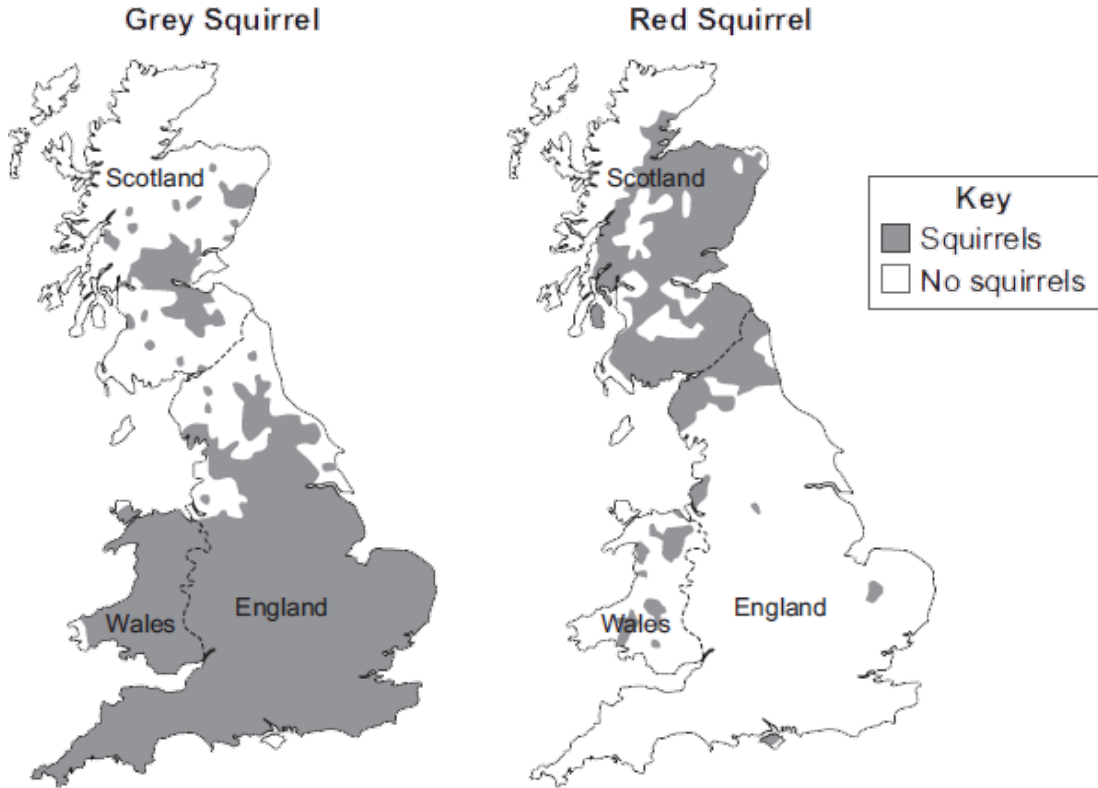


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Scientists suggested that the distribution of grey squirrels and red squirrels is linked to the type of trees in woodlands.

- (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**

	<b>Grey squirrel</b>	<b>Red squirrel</b>
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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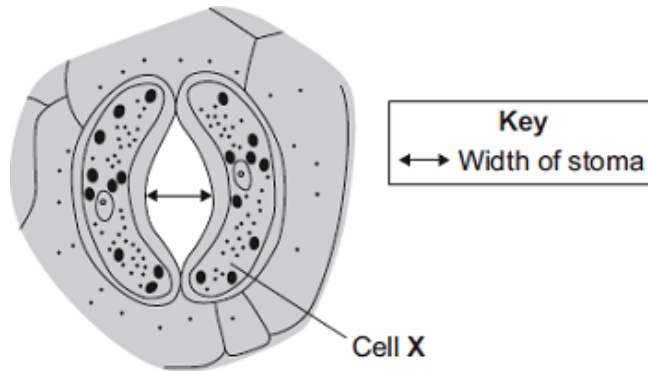
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(3)  
 (Total 7 marks)

**Q11.** 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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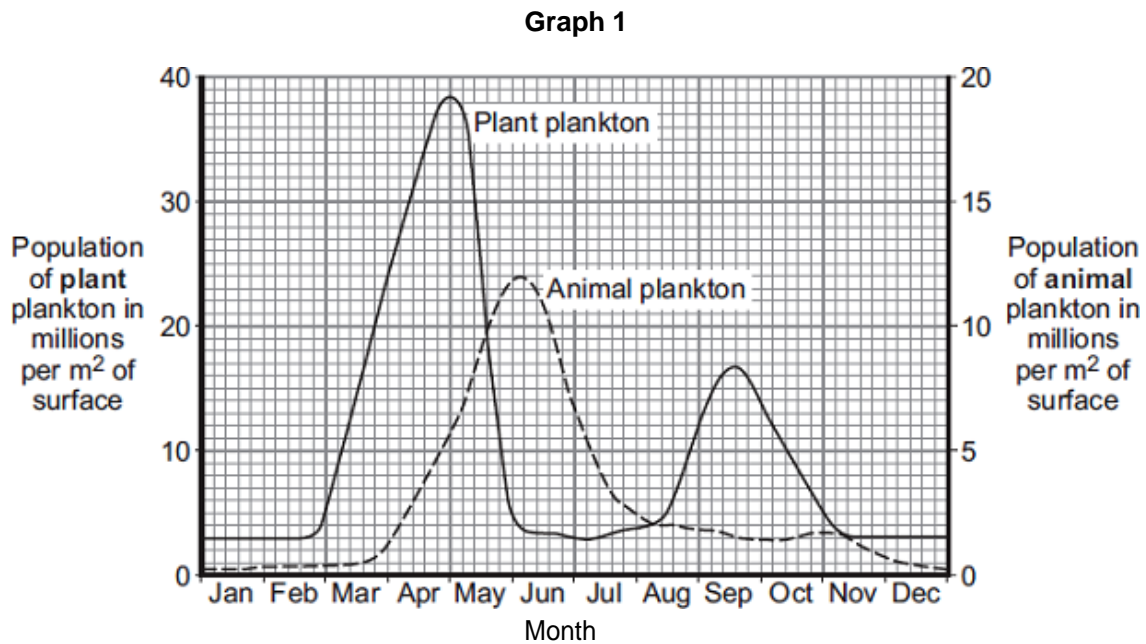
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(4)  
(Total 5 marks)

**Q12.** 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.

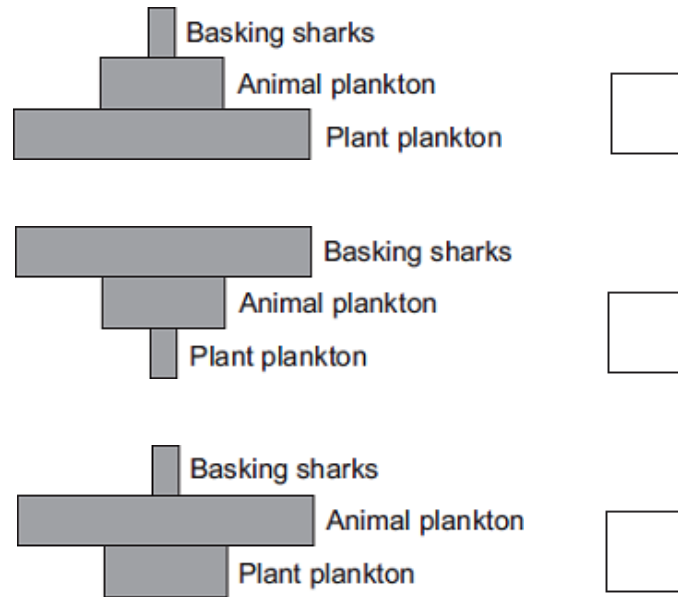


(a) Basking sharks eat animal plankton. Basking sharks grow up to 8 metres long.

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

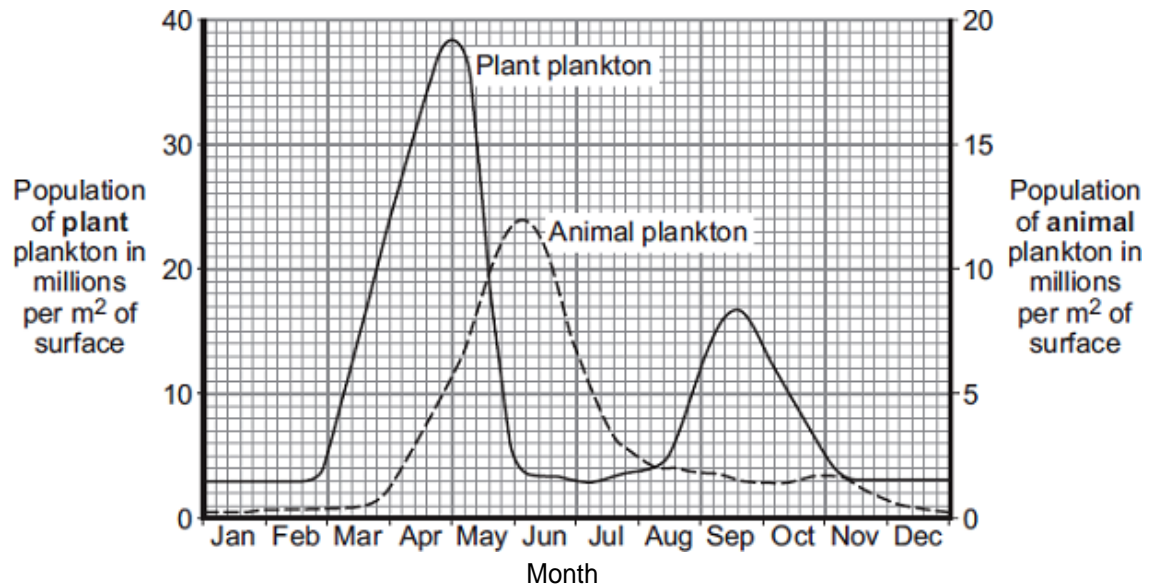
Which is the correct shape for the pyramid of biomass to show the relationship between plant plankton, animal plankton and basking sharks, in June?

Tick (✓) **one** box.

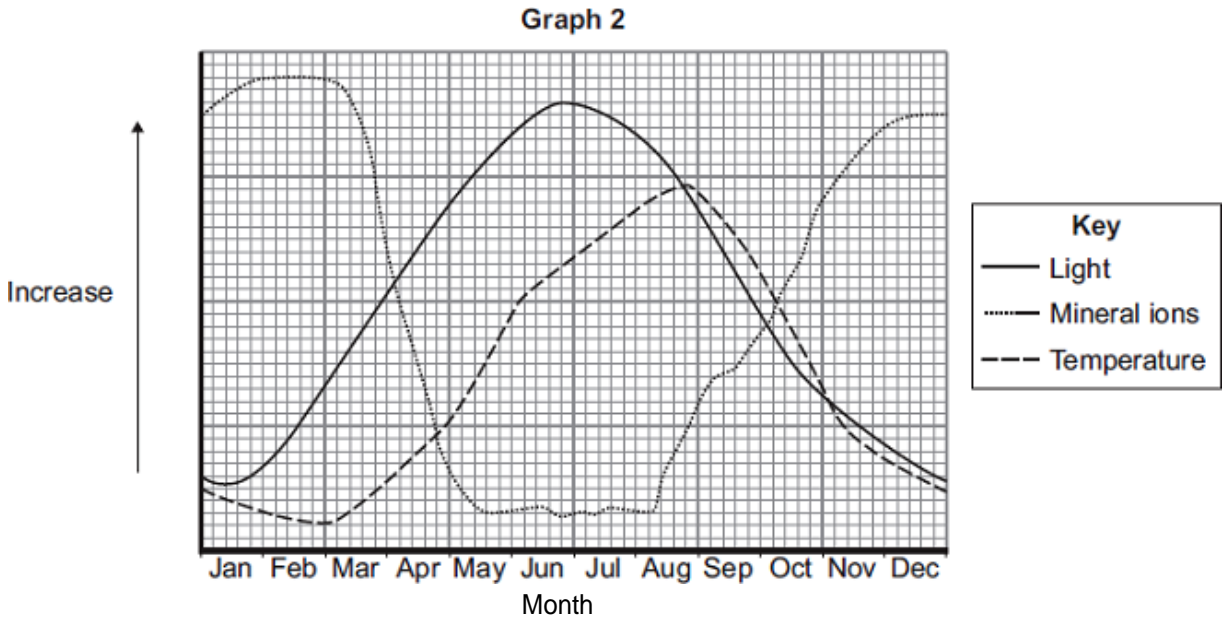


(1)

**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.



(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)**

- M1.** (a) extremophile(s) 1
- (b) (i) common (periwinkle) and flat (periwinkle)  
*either order, both required* 1
- (ii) (common and flat) both live in the same habitat / area / named area  
*allow habitats overlap the most* 1
- (iii) any **two** from:
- would have wrong food
  - would otherwise be exposed to (specific) predators
  - cannot tolerate extended exposure to air **or** reduced submersion in seawater  
*allow cannot tolerate temperature / dehydration*
  - cannot tolerate high salt concentration (in rock pools)  
*allow low salt concentration (in rock pools)*
  - cannot compete with small periwinkle
- 2 **[5]**

##

- (a) light and/or temperature too low in winter,  
increasing light in spring leads to increase in photosynthesis  
increasing temperature in spring leads to increasing metabolism/  
growth/reproduction  
*for 1 mark each* 3
- (b) they run out of minerals  
*for 1 mark* 1
- [4]**

- M3.** (a) 4 of:  
intensification due to need to improve efficiency of energy transfer;  
has led to developing fast growing crop varieties;  
native plants cannot compete with these;  
for e.g. light/water/minerals;  
effect of herbicides;  
pesticides killing pollinating insects  
*each for 1 mark* 4

- (b) recommend a variety of measures; (can be implied)  
because rotational will allow these species to continue;  
permanent will allow others;  
leading to conservation of a wide range of species

*each for 1 mark*

4

[8]

**M4.** 7 of e.g.

need for resumption of *some* legal trading because:  
conservation costs money  
need to generate income  
to justify giving over tracts of land needed to support it  
need to keep elephant numbers consistent with vegetation available  
need for hard currency by African countries  
counter arguments:  
'right to life' of elephants  
need to prevent effects of poaching on numbers  
if trading allowed again

*each for 1 mark*

[7]

**M5.** any **three** from adaptation **and** effect:

*ignore references to ions throughout ignore animals eating plant*

few leaves / no leaves / little growth above ground / low surface area  
above ground so less water loss

*do **not** accept zero water loss*

deep roots

so can reach water **or** because surface soil is likely to dry out

*accept 'moisture' for water*

roots near surface so can obtain water when it does rain

widespread roots or many roots so can obtain water from a large area

swollen stem so can store water

[3]

**M6.** (a) wing pattern similar to *Amauris*

1

birds assume it will have foul taste

1

(b) mutation / variation produced wing pattern similar to *Amauris*  
do **not** accept breeds with *Amauris*  
do **not** accept idea of intentional adaptation 1

these butterflies survived 1

breed / genes passed to next generation 1

[5]

**M7.** (a) stays cool  
ignore shade 1

less sweat 1

(b) any **two** from:

- breathing rate less
- less water lost via breath  
*less can be implied*
- less water from respiration 2

[4]

**M8.** (a) variation / mutation 1

individuals with characteristics most suited to environment  
survive  
*allow survival of the fittest* 1

genes passed to next generation **or** these individuals reproduce 1

(b) any **two** from:

- similar in size to Emperor penguin **or** bigger than all penguins
- large size is adaptation to cold climate
- since less heat loss per unit of body volume **or** smaller surface area / volume ratio

2

[5]

**M9.** (a) wing pattern similar to *Amauris*

*allow looks similar to Amauris*

1

birds assume it will have an unpleasant taste

1

(b) mutation / variation produced wing pattern similar to *Amauris*

*do not accept breeds with Amauris*

*do not accept idea of intentional adaptation*

1

these butterflies not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]

**M10.** (a) Scotland

1

any **one** from

- Scotland 15 to 20% / about 1/5<sup>th</sup> to 1/7<sup>th</sup> but England and Wales / the others are less / lower / reasonable estimated figures
- $\frac{13.4}{79}$  is greater than England /  $\frac{11.4}{130}$  and Wales /  $\frac{2.8}{21}$

1

(b) (i) broadleaf woodlands have more grey squirrels **or** broadleaf woodlands have less red squirrels

*allow converse referring to conifers*

1



- (ii) Wales has more conifers and / but more grey squirrels  
**or**  
 Wales has less broadleaf and / but more grey squirrels  
*allow converse for red squirrels*

1

- (c) any **three** from:  
*answers must be comparative they = grey squirrels*

grey squirrels  
*allow converse arguments for red squirrels*

- have wider range/ more types of food
- are resistant to parapox (virus) but reds are not  
*ignore reference to other disease*
- have more young each year / litter
- young more likely to survive (in mixed populations)

3

[7]

- M11.** (a) guard cell  
*ignore stoma / stomata*

1

- (b) Species A :  
*allow converse points for species B*

stomata open in dark / at night **or** close in light / in day

1

stomata closed during warm(est) period **or** open when cool(er)

1

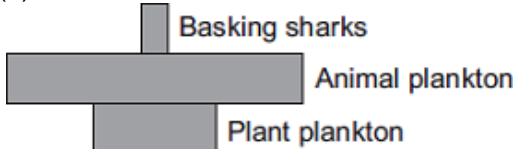
heat (energy) / warmth increases evaporation / transpiration  
*must give explicit link between heat and transpiration*

1

reduces water loss / evaporation / transpiration  
*ignore photosynthesis*

1

[5]

- M12.** (a)
- 

*if more than one box is ticked award no mark*

1

- (b) increasing / higher light / temperature  
*ignore references to months other than February – April*  
*do **not** accept mineral / ions increase* 1
- more / increased photosynthesis  
*for both marks there must be a reference to 'more' at least once*  
*(e.g. 'more light for photosynthesis' gains 2 marks)*  
*allow 1 mark for reference to light **and** photosynthesis without an*  
*idea of 'more'* 1
- (c) increase due to increase in plant plankton / food  
*ignore references to months other than April – July* 1
- decrease due to fall in plant plankton / food **or** decrease as eaten by (basking) sharks  
*allow decrease as eaten by predators / animals / fish* 1
- (d) fall due to use / intake by plant (plankton)  
*ignore ref to no change section of graph*  
*for fall allow March / April*  
*ignore May / February* 1
- increase due to decay / decomposition / breakdown  
*for increase allow any month in range August to November*  
*ignore December* 1
- of dead (plant / animal) plankton  
*allow of dead organisms / waste* 1

[8]

