

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

4461/02



S15-4461-02

SCIENCE A/BIOLOGY

**BIOLOGY 1
HIGHER TIER**

P.M. TUESDAY, 9 June 2015

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	7	
2.	6	
3.	5	
4.	6	
5.	6	
6.	5	
7.	7	
8.	6	
9.	6	
10.	6	
Total	60	

ADDITIONAL MATERIALS

In addition to this paper you may require a calculator and a ruler.

INSTRUCTIONS TO CANDIDATES

Use black ink or black ball-point pen.

Write your name, centre number and candidate number in the spaces at the top of this page.

Answer **all** questions.

Write your answers in the spaces provided in this booklet.

INFORMATION FOR CANDIDATES

The number of marks is given in brackets at the end of each question or part-question.

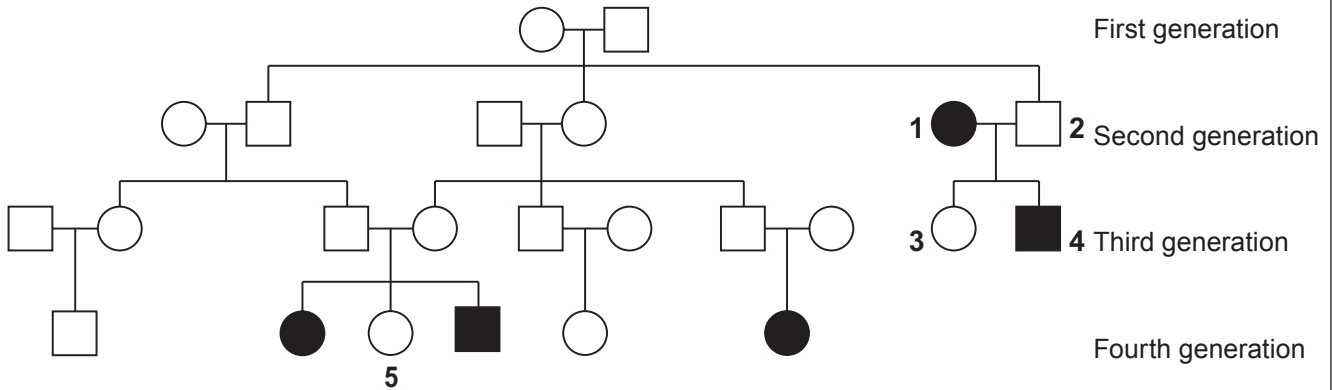
You are reminded that assessment will take into account the quality of written communication (QWC) used in your answer to questions **4** and **10**.

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Answer all questions.

1. Cystic fibrosis is a hereditary disease that affects around 1 in every 2 500 babies born in the UK. It affects several organs in the body including the lungs and pancreas. The disease is caused by a recessive allele (n).

The family tree below shows the history of the inheritance of cystic fibrosis.



- Female
- Male
- Female with cystic fibrosis
- Male with cystic fibrosis

(a) (i) State the genotype of person number 2. [1]

(ii) Explain your answer. [2]

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(b) (i) State the genotype of person number 3. [1]

(ii) Explain your answer. [2]

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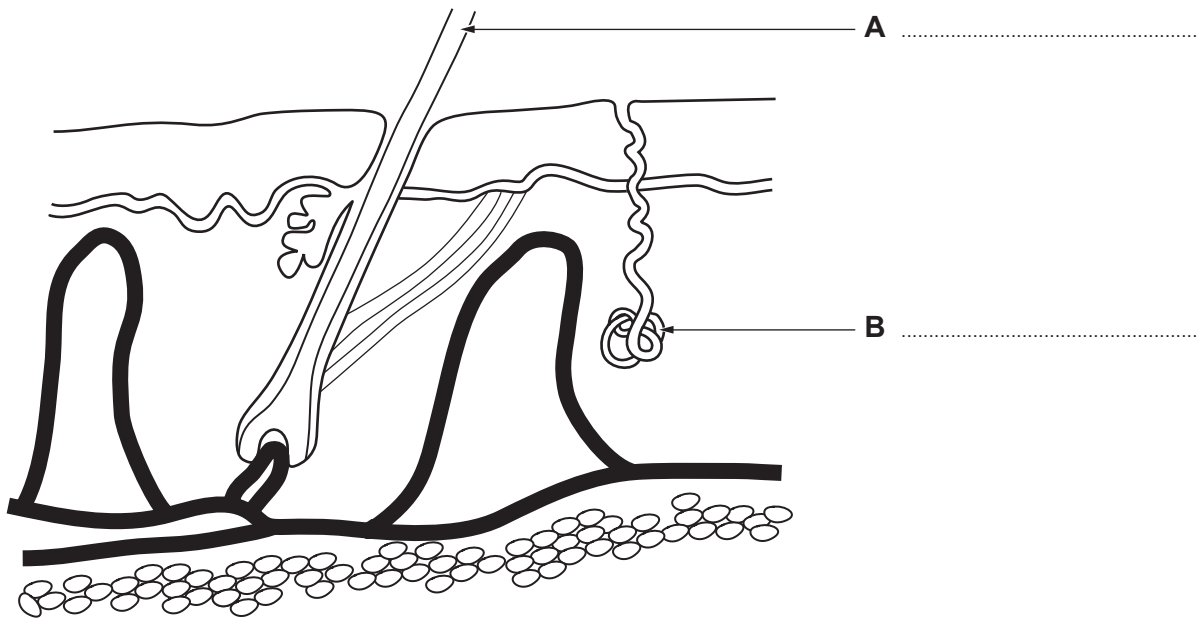
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(c) What is the probability of person number 5 being homozygous dominant? [1]
Place a circle around the correct answer.

- 25% 50% 75% 100%

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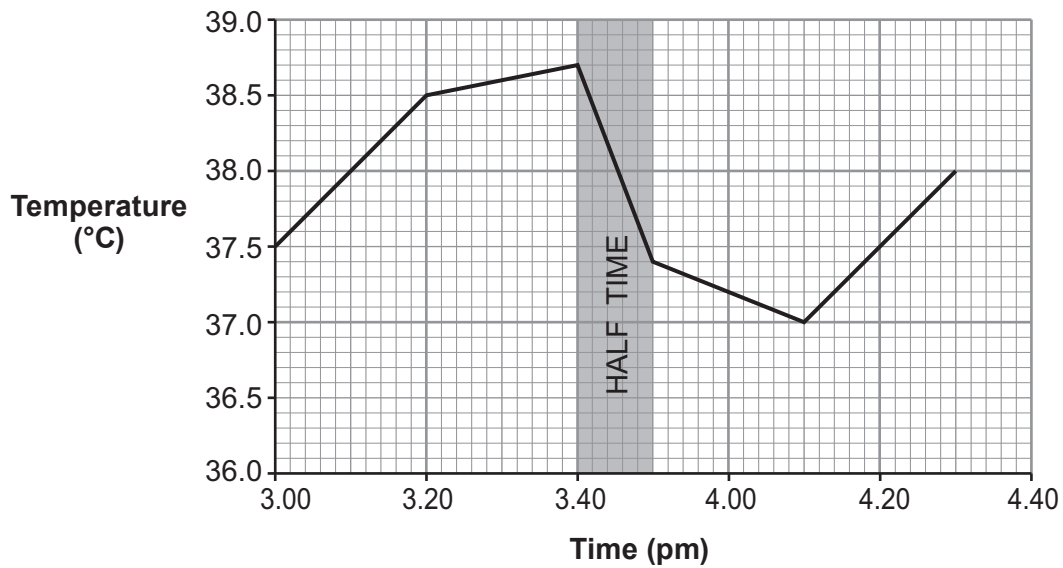
2. The diagram shows a section through the skin.



(a) Label parts **A** and **B** on the diagram.

[2]

(b) The graph shows the body temperature of a player during the course of a rugby match.



(i) State **two** responses made by the skin to cause the change in body temperature observed between 3.40pm and 4.10pm. [2]

I.

II.

(ii) Explain how the narrowing of blood vessels in the skin helps maintain body temperature in cold conditions. [2]

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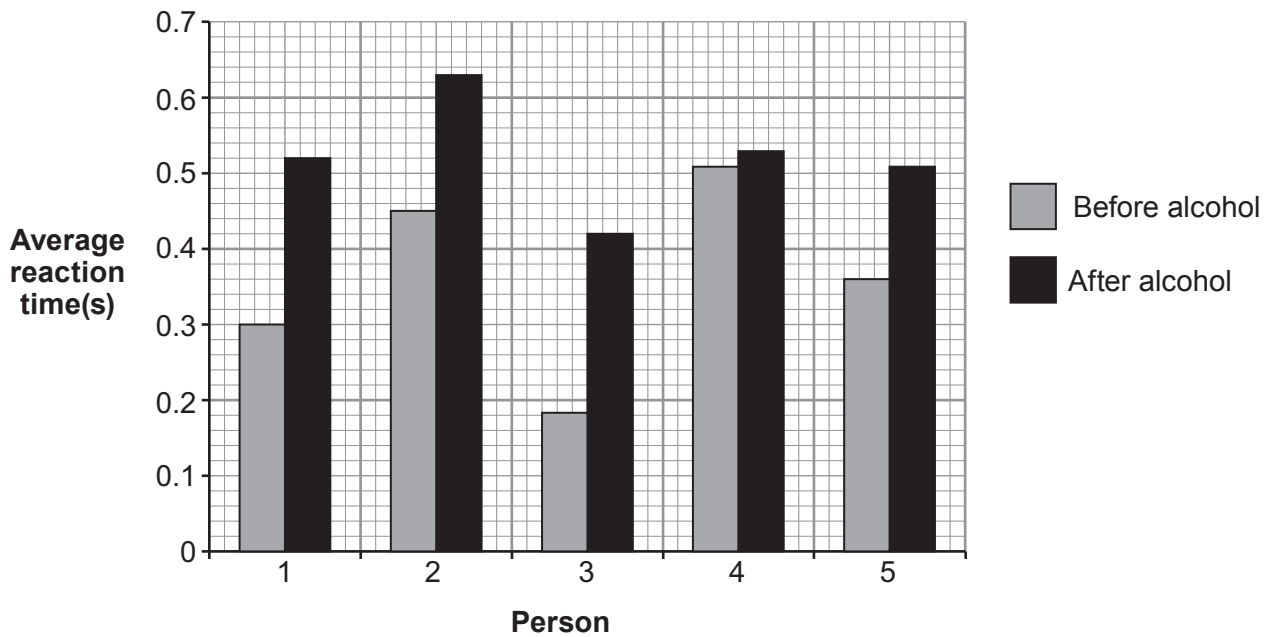
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3. (a) State **two** ways in which excessive alcohol consumption can cause long-term physical damage to the body. [2]

(i)

(ii)

(b) An investigation was carried out into the effect of alcohol on reaction times. Five people were asked to drink some alcohol and the time taken to respond to a stimulus was recorded. Reaction times before drinking the alcohol were also recorded. The results are shown in the graph below.



(i) What conclusion can be drawn from the results shown in the graph? [1]

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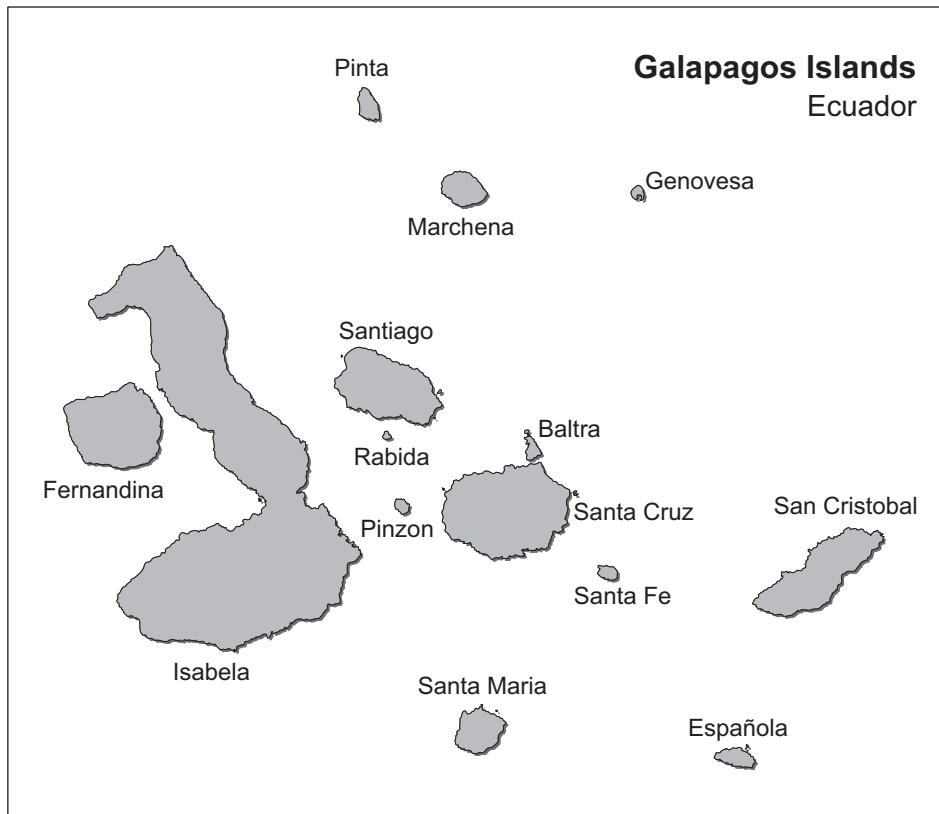
(ii) Which person has the longest reaction time after drinking alcohol? [1]

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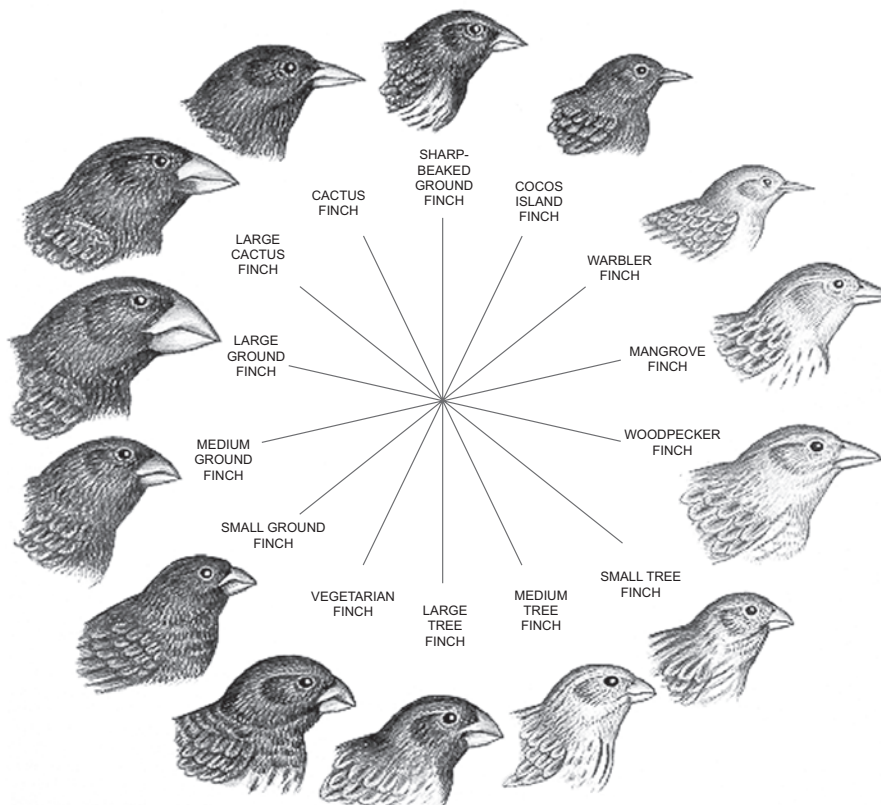
(iii) How does drinking alcohol before driving a car increase the risk of having a road traffic accident? [1]

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5. When Charles Darwin visited the Galapagos Islands he collected birds from the different islands. On his return to Britain he studied the birds and thought that they had all evolved from a single bird type. These birds became known as Darwin's Finches.



Darwin's Finches (drawn to scale)



(a) (i) What **two** observations can be made from the drawings opposite about the birds' beaks? [2]

I.

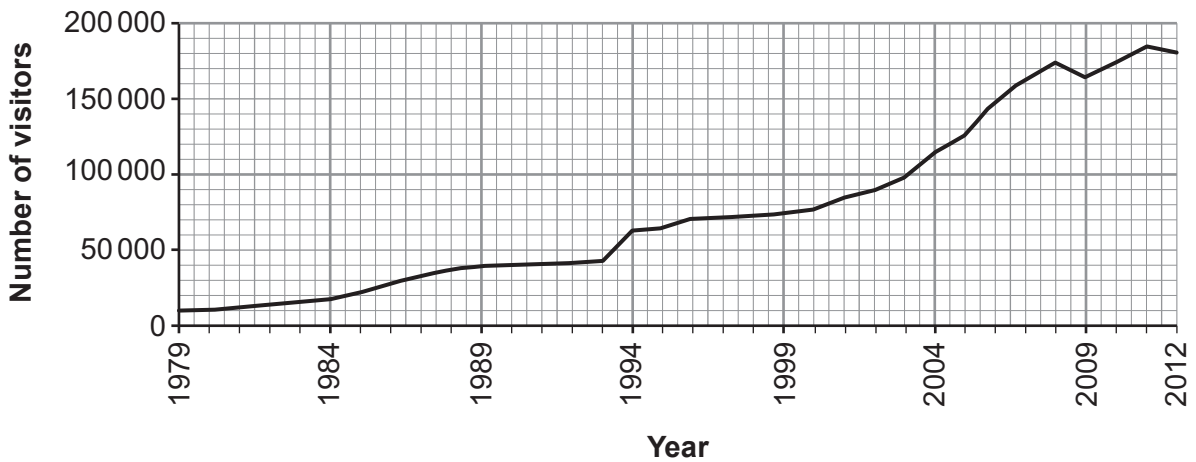
II.

(ii) Suggest the advantage to the birds of the variation in their beaks. [1]

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(b) The Galapagos Islands contain 1 300 species found nowhere else on earth. In 1978 the islands were named one of the first UNESCO World Heritage Sites. Since then human activity has had a devastating effect. The human population and economy of the islands are expanding rapidly and unsustainably. Annual visitor numbers have increased from 12 000 in 1979 to over 180 000 in 2012.

Galapagos Islands – annual visitor numbers 1979 – 2012



Suggest **three** ways in which the Galapagos Conservation Trust (GCT) could reduce the impact that increasing tourism has on the islands. [3]

(i)

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(ii)

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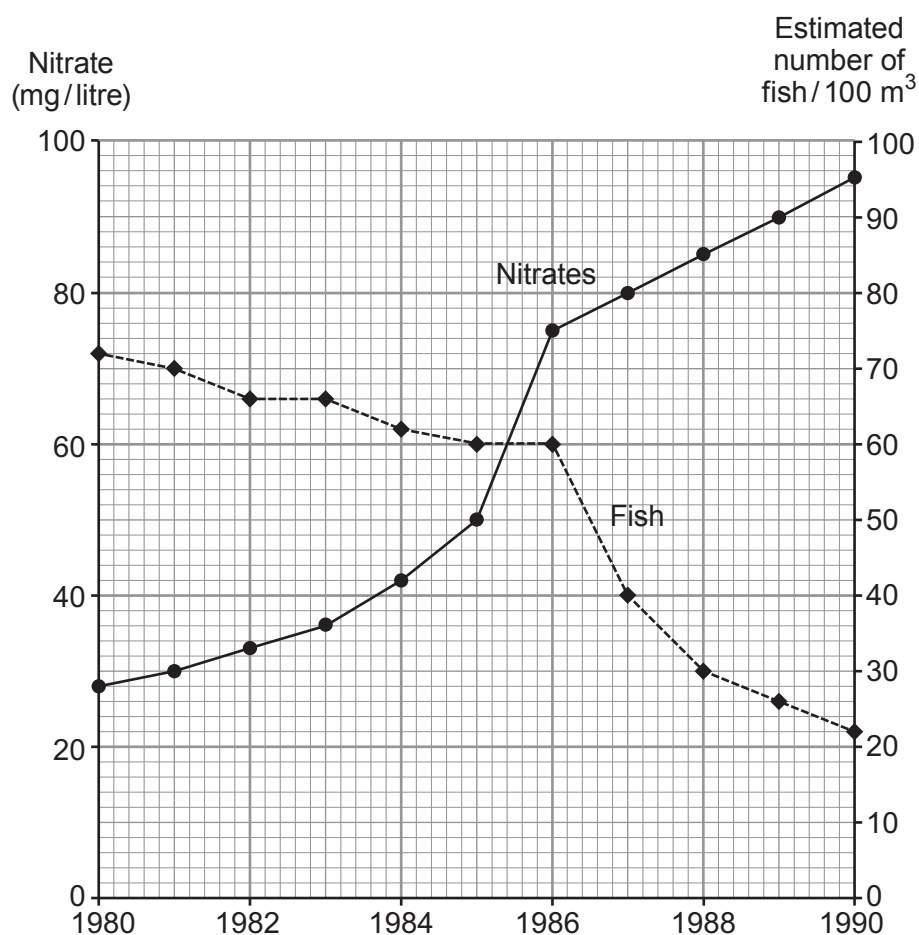
(iii)

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6. The Welsh Environmental Authority (Natural Resources Wales) monitors the concentration of nitrate and fish populations in rivers and lakes.

The graph shows the results for a lake near farmland which was regularly treated with fertiliser from 1980 to 1990.



Use the graph and your knowledge of indicator species and pollution by fertilisers to answer the following.

- (a) Between which years was the highest **rate** of increase of nitrate pollution in the lake? [1]

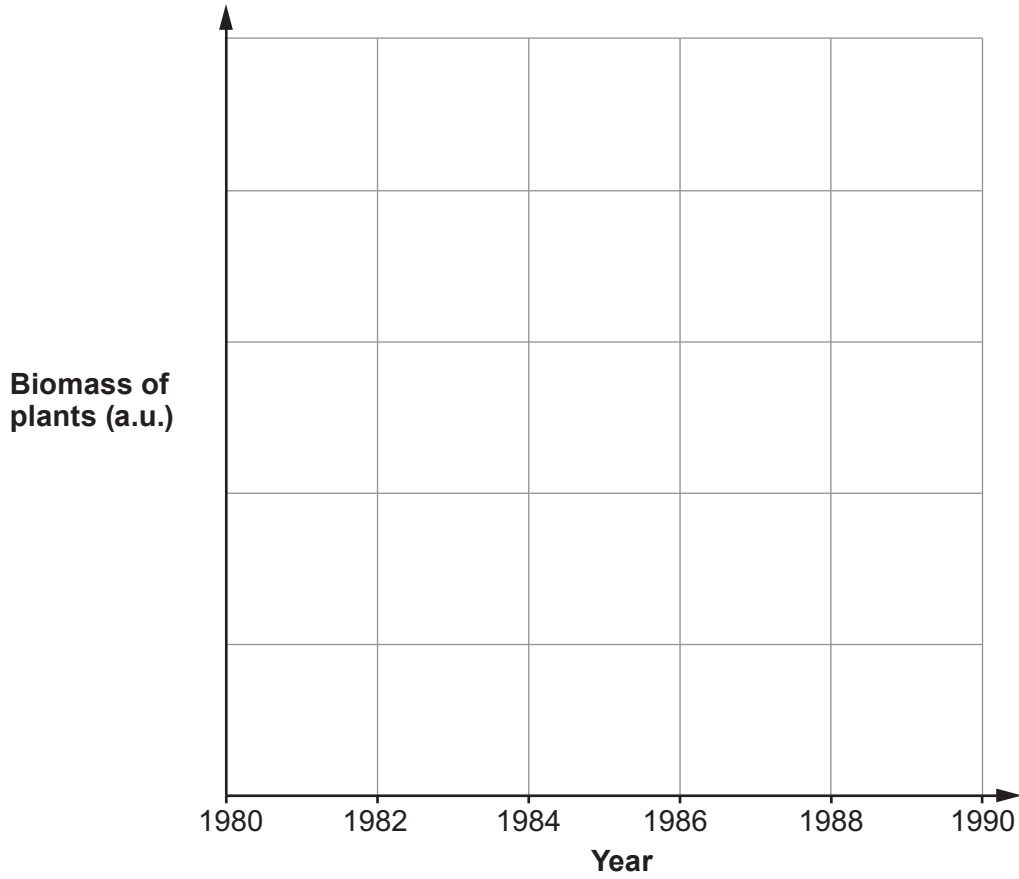
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- (b) In which year would you expect the highest concentration of: [1]

(i) oxygen in the lake,

(ii) bacteria in the lake?

- (c) On the grid below sketch a line graph to show the **expected** changes in the biomass of plants in the lake from 1980 to 1990. [3]



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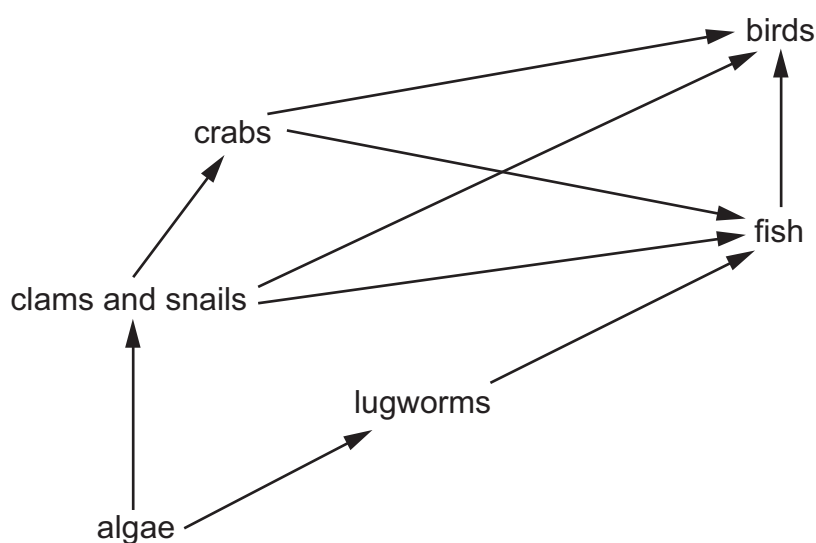
7. A very large biomass and variety of organisms live in the sand and mud of seashores. The table shows the composition of invertebrates living in sand and mud on a seashore in Cardigan Bay in west Wales.

	living in mud	living in muddy sand	living in sand
total invertebrates (per m ³)	15 000	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

- (a) Underline the type of seashore that has the greatest variety of organisms. [1]

mud muddy sand sand

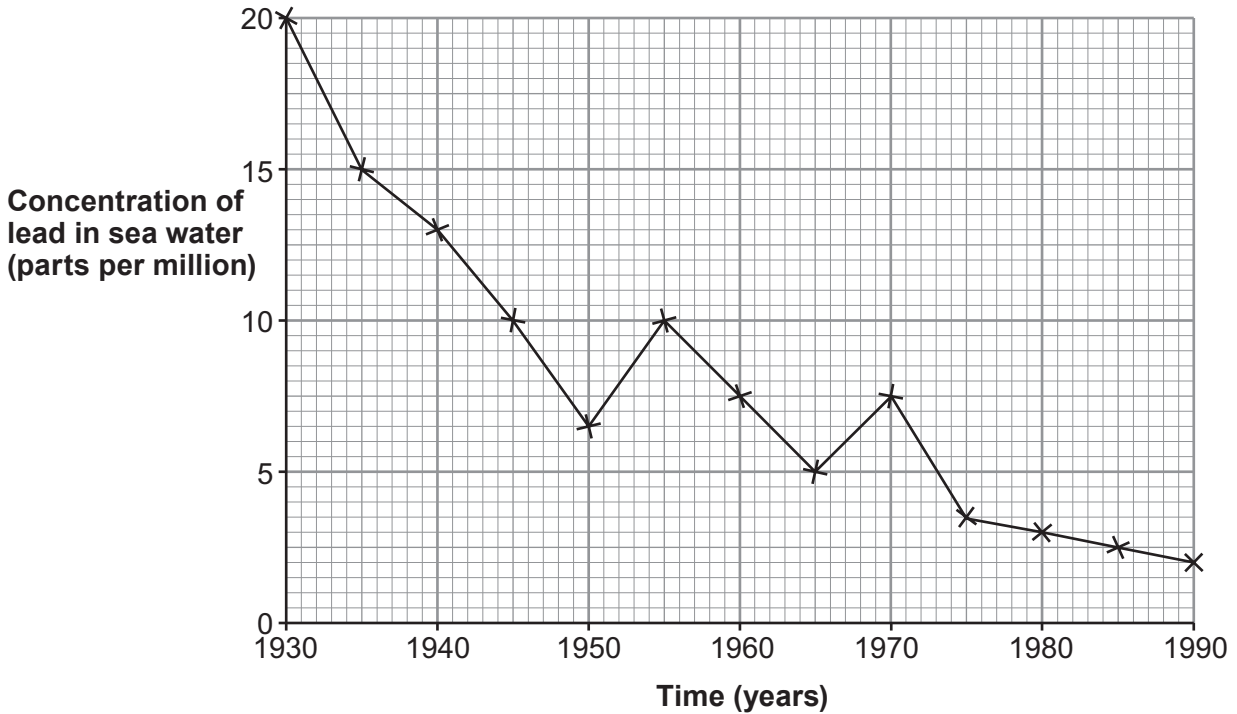
- (b) A simplified food web for a muddy shore is shown below.



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]

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

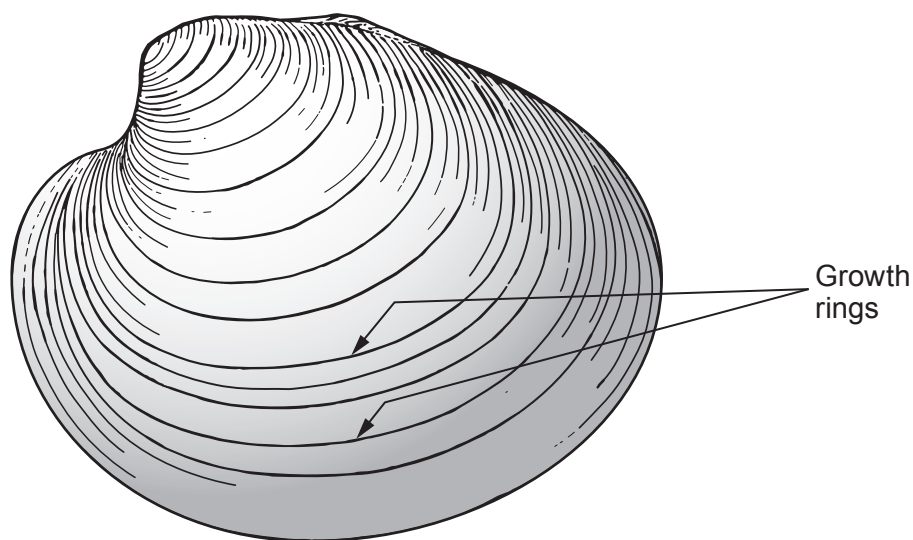


- (i) What was the general trend in the concentration of lead pollution in Cardigan Bay from 1930 to 1990? [1]

- (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 %

- (iii) The drawing shows a 60 year old clam, *Arctica islandica* from Cardigan Bay.



Arctica islandica has growth rings on its shell. Each year, it adds a growth ring made of chemicals absorbed from sea water during that particular year. Scientists at Aberystwyth University have developed a method of analysing the chemical composition of each separate growth ring.

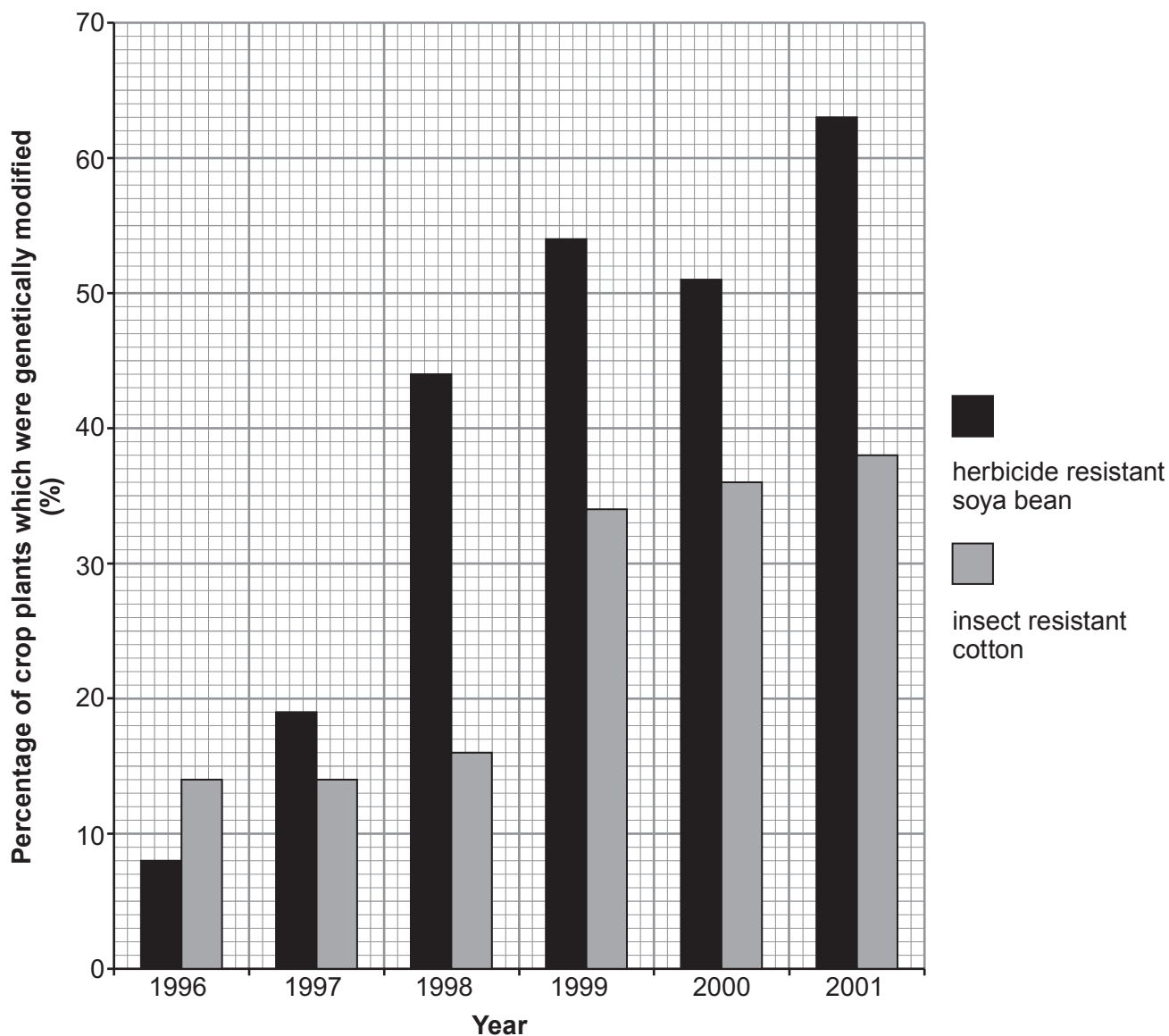
Suggest how *Arctica islandica* can be used to produce the graph shown opposite. [2]

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8. Soya bean and cotton are crop plants grown in the USA. The bar chart shows the percentage of these crops grown between 1996 and 2001 which were genetically modified (GM).



- (a) What does the general trend shown in the bar chart suggest about the attitude towards planting GM crops between 1996 and 2001 in the United States? [1]

(b) Describe how soya bean plants could be made resistant to herbicide using GM crop technology. [2]

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(c) The effect of insects on the yield of cotton has been investigated for GM insect resistant cotton plants and for non-GM cotton plants. The results are shown in the table:

	GM insect resistant cotton plants	non-GM cotton plants
mean number of insecticide sprays per month needed to control leaf eating insects	0.6	3.7
mean number of insecticide sprays per month needed to control sap sucking insects	3.6	3.5
yield (kg per hectare)	1500.0	800.0

State **three** conclusions that can be drawn from the data in the table. [3]

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II.

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III.

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9. (a) Until the 1960s, turkeys, bred for meat on turkey farms, all had black feathers. Then, mutant pure white-feathered turkeys were hatched in a turkey farm. Turkey farmers used the mutant turkeys to produce all white-feathered flocks of turkeys. Almost all turkeys sold in supermarkets today are of the white-feathered variety.



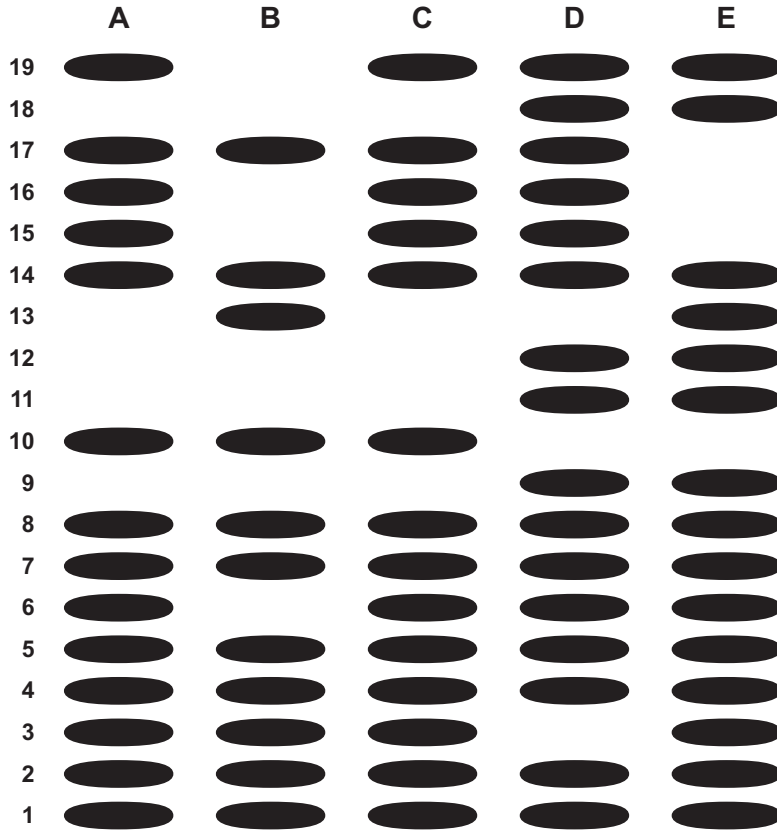
- (i) What type of genetic variation is shown by the feather colour of turkeys? [1]

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- (ii) Why is it not possible to breed black-feathered turkeys from white-feathered turkeys? [1]

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(b) Research into breeding turkeys for various characteristics is taking place. Scientists have attempted to genetically modify some varieties to increase meat production. The genetic profiles of five turkeys (**A**, **B**, **C**, **D** and **E**) are shown below.



The turkeys are shown by the letters **A** to **E**. The positions of the bands of the profiles are shown by the numbers **1** to **19**.

(i) Two of the turkeys were hatched from the same egg. Use the genetic profiles to identify them. [1]

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(ii) The absence of a band at position **10** leads to an inherited disease caused by the altered DNA. Identify the **two** turkeys with this inherited disease and suggest why it would not be a good idea to clone these two turkeys. [2]

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(iii) All the turkeys, except **D**, are white-feathered. Which number shows the position of the mutation for feather colour? [1]

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- 10.** 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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