Surname	Centre Number	Candidate Number
Other Names		0

GCSE

4471/02

ADDITIONAL SCIENCE/BIOLOGY

BIOLOGY 2
HIGHER TIER

A.M. WEDNESDAY, 8 January 2014

1 hour

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

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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 used in your answer to question **4** and question **10**.

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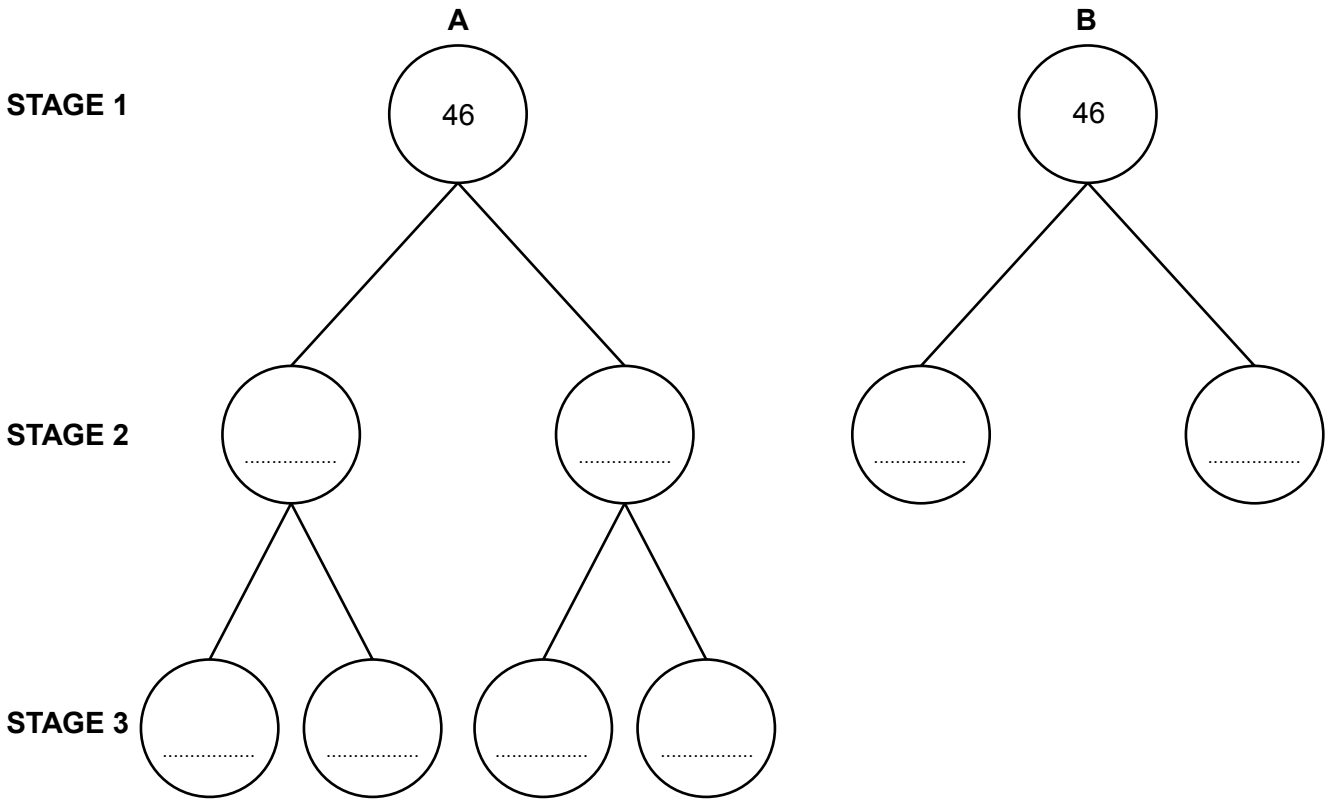
Answer **all** *questions.*

1. The diagram below shows the two **different** types of cell division **A** and **B**, which occur in the human body.



(a) Name the type of cell division shown in diagram **A**. ..... [1]

(b) The cells in **STAGE 1** each contain 46 chromosomes. Complete the diagram by writing in the number of chromosomes found in ***each*** of the cells in **STAGE 2** and **STAGE 3**. [2]

(c) The cells drawn in **STAGE 3** develop into specialised cells. What name is given to these cells? [1]

.....

(d) Complete the sentence below by placing a **circle** around the correct word. [1]

All the cells in **STAGE 3** are genetically **identical / different**.

(e) Name **one** process during which the type of cell division shown in diagram **B** would occur. [1]

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2. Some students wanted to estimate the number of dandelions on a school playing field. The playing field was too large to count every dandelion so they sampled a 10m × 10m area of the field using a quadrat.

© Martyn F. Chillmaid/Science Photo Library

(a) The stages the students used in their sampling technique are listed below in the **WRONG ORDER**. Write the numbers **1**, **2**, **3** and **4** in the table below to show the correct order. [3]

Stage in the sampling technique	Number
Calculate the number of dandelions on the playing field	
Repeat the sampling 10 times	
Select a random sampling method	
Drop the quadrat and count the number of dandelions	

(b) Why is it important that when the students sample in the chosen area of the field it is done randomly? [1]

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3. Sian and Rhys were investigating the use of visking tubing as a model gut.
The following is an extract from their notebook showing the method they used.

(i) Soak a piece of visking tube in water for 10 minutes.

(ii) Tie a knot in one end of the visking tube.

(iii) Fill the visking tube with starch solution and tie the open end of the tubing.

(iv) Suspend the visking tubing in a beaker of water.

(v) Test the water in the beaker every 15 minutes for the presence of starch and glucose.

(vi) After 45 minutes inject amylase enzyme into the visking tubing.

(vii) Continue to test the water for starch and glucose every 15 minutes.

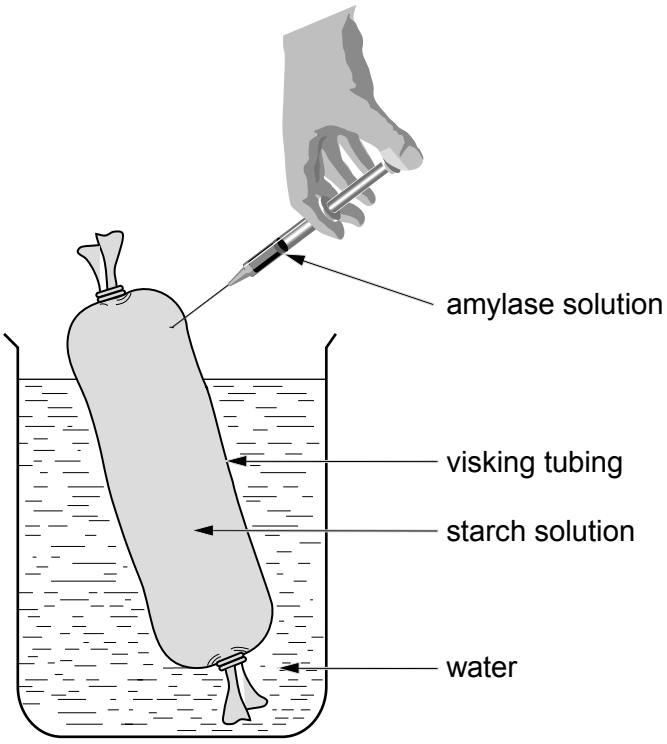

Table of results.

Time (minutes)	Starch present	Glucose present
0	No	No
15	No	No
30	No	No
45	No	No
60	No	Yes
75	No	Yes
90	No	Yes

Amylase added →

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(a) After the amylase was added, glucose was present in the sampled water. Explain this result. [3]

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(b) State why starch was not found in the sampled water. [1]

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(c) In the model gut shown opposite what does the water surrounding the visking tubing represent in the living body? [1]

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(d) Complete the following table about food tests. [2]

Substance tested for	Reagent used	Colour of reagent	Colour with positive result
	Iodine solution		blue-black
Glucose		blue	

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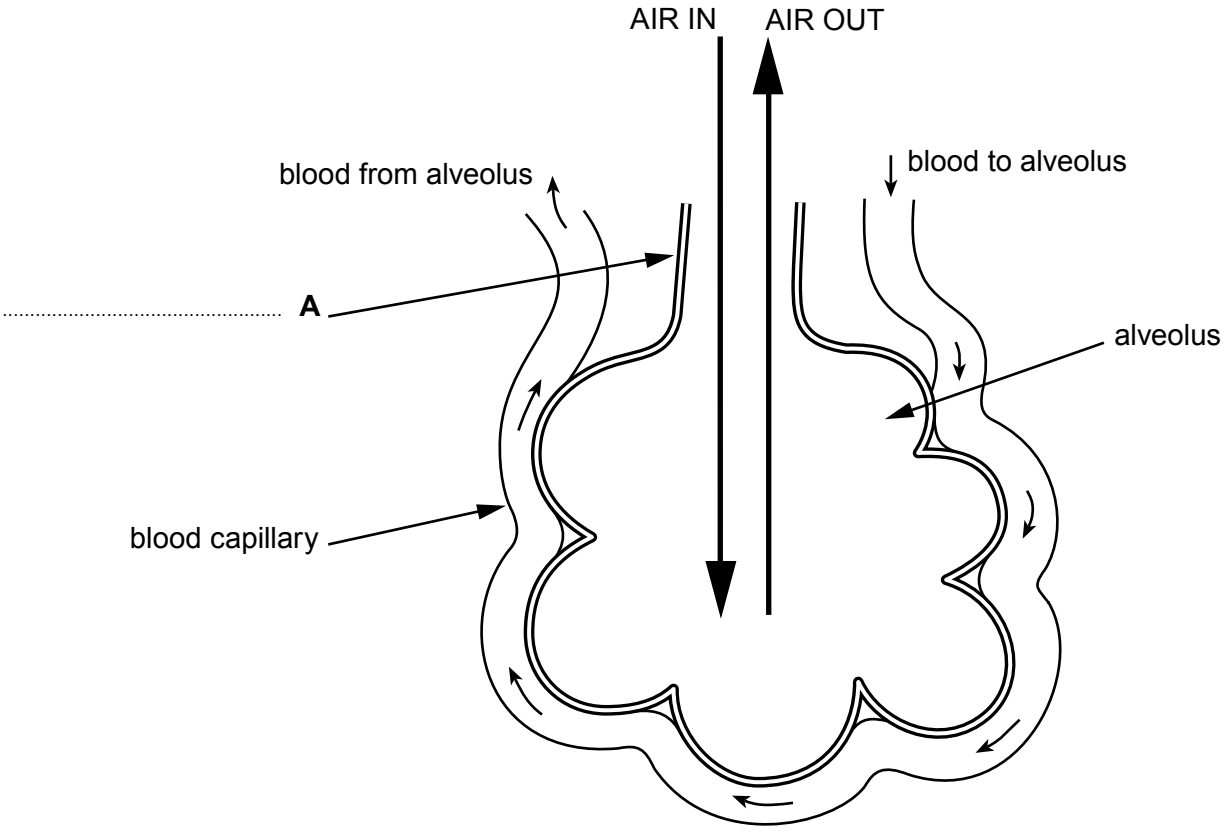
4. The diagram shows an alveolus and its blood supply.



(a) Complete label **A** on the diagram above. [1]

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(b) Explain how gas exchange takes place between the alveolus and blood capillary. Include in your answer a description of how the alveolus is adapted to help this gas exchange. [6 QWC]

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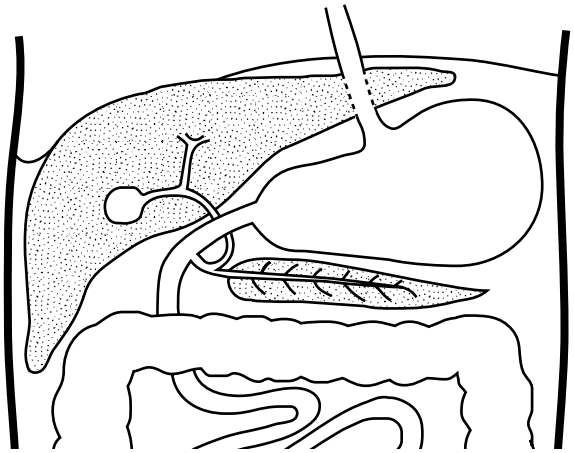
5. The diagram shows part of the human digestive system.



(a) (i) Name the organ shown in the diagram above which: [1]

I. secretes bile; .....

II. label this organ on the diagram above.

(ii) Name the organ shown in the diagram above which: [1]

I. stores bile; .....

II. label this organ on the diagram above.

(b) The table below shows the results of an experiment to investigate the digestion of olive oil (a lipid). The contents of three test tubes are shown in the table. The contents of the test tubes were analysed for the presence of fatty acids every 5 minutes for a period of 30 minutes.

		Time (minutes)						
Tube	Test samples	0	5	10	15	20	25	30
1	water + oil	**–**	**–**	**–**	**–**	**–**	**–**	**–**
2	water + oil + bile	**–**	**–**	**–**	**–**	**–**	**–**	**–**
3	water + oil + bile + lipase	**–**	**+**	**++**	**+++**	**++++**	**++++**	**++++**

Key: **–** = no fatty acids present

+ = fatty acids present

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(i) Bile plays a very important role in the digestion of lipids but the results in Tube **2** show that it is not directly involved in the production of fatty acids. Describe the role played by bile in the digestion of lipids. [2]

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(ii) The production of fatty acids in Tube **3** did not increase after 20 minutes. Suggest a reason for this. [1]

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(iii) Apart from fatty acids, name another product of lipid digestion which could have been tested for during this experiment. [1]

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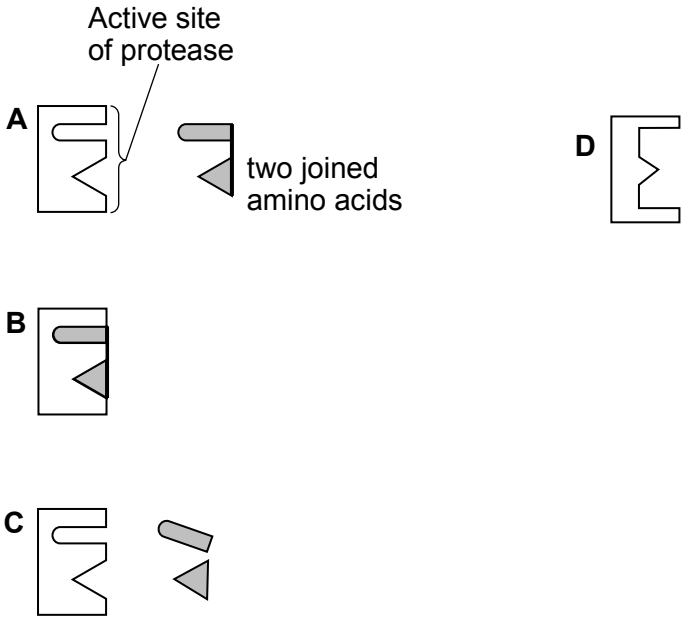
6. Diagrams **A** - **C** illustrate the 'lock and key' theory of enzyme action. It shows how a protease is able to catalyse the separation of two joined amino acids. Diagram **D** shows the protease after it has been denatured.

The "lock and key" theory of enzyme action



(a) What name is given to the structure represented by diagram **B**? [1]

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(b) Explain why the denatured protease **D**, is unable to catalyse the separation of the two amino acids. [2]

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(c) State **two** factors which affect the rate of enzyme controlled reactions. [2]

I. .....

II. .....

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7. Some physical and chemical changes were measured in a rock pool on the sea shore at low tide. The measurements were made during daylight hours over a period of one week. The rock pool contained a high biodiversity of animals and algae.

The results are shown in the table below.

	Physical and chemical conditions in rock pool water			
Time of day	Carbon dioxide (mg/l)	Oxygen (mg/l)	Temperature (°C)	Salt (%)
10 am	97.0	9.4	14.4	3.25
11 am	84.7	10.9	14.7	3.26
12 noon	74.3	13.9	15.6	3.27
1 pm	60.6	14.0	20.8	3.29
2 pm	50.8	17.4	21.3	3.41
3 pm	65.1	15.1	19.6	3.33
4 pm	85.0	13.2	15.3	3.26

(a) Which limiting factor of photosynthesis is influenced by the animals in the rock pool? [1]

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(b) Explain the effect of temperature on the salt concentration in the rock pool. [2]

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(c) Explain how the animals living in the rock pool could be affected by an increase in the salt concentration of the water. [4]

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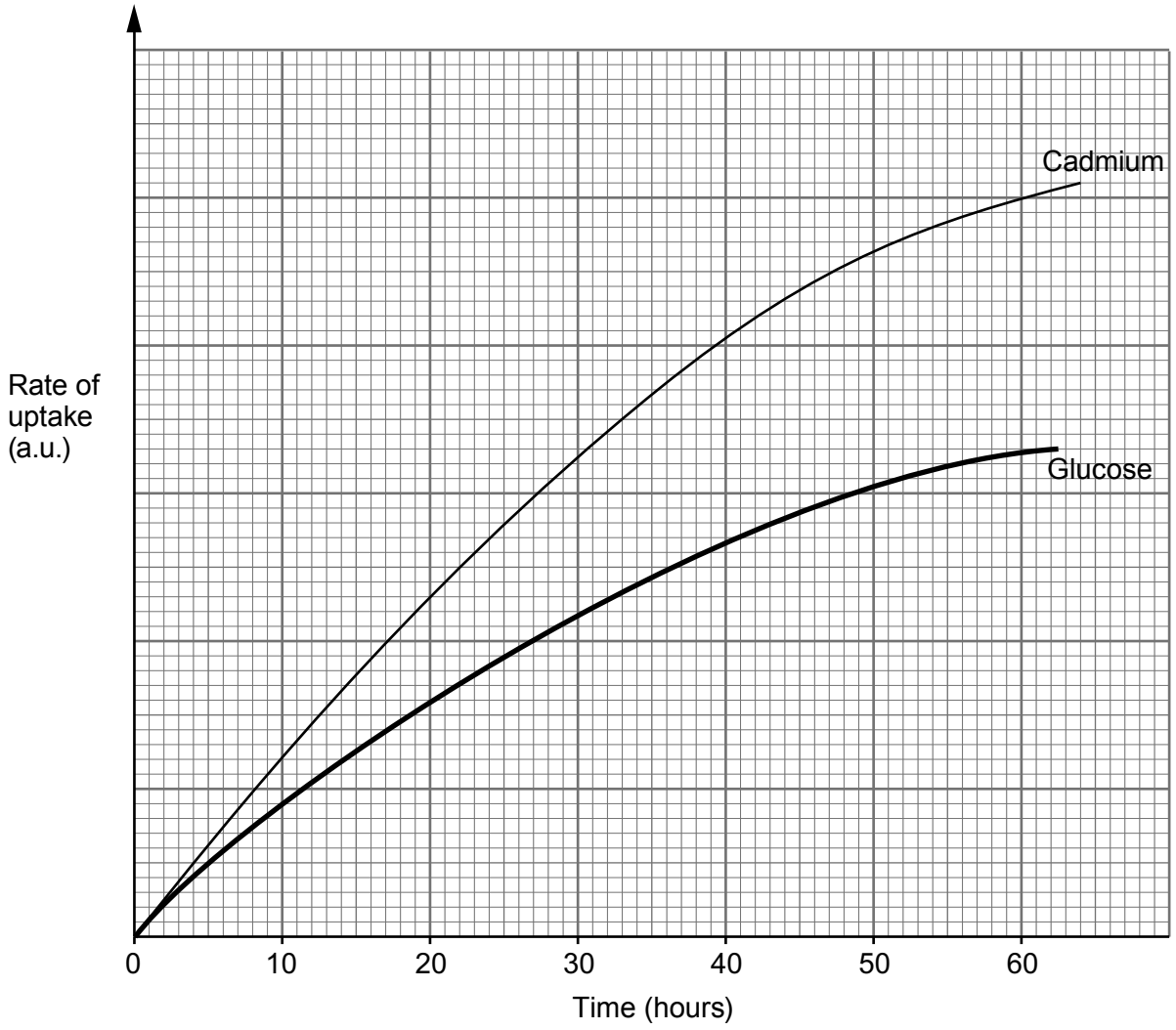
8. The fungus, *Aspergillus* has been used in Malaysia to extract the heavy metal, cadmium, from the waste produced in the production of palm oil. The graph below shows the rate of uptake of glucose and cadmium by *Aspergillus* over a sixty hour period.



The table below shows the effect of oxygen and glucose on the uptake of cadmium by *Aspergillus* over a sixty hour period.

Conditions	Uptake of cadmium by Aspergillus over a sixty hour period (a.u.)
With glucose and oxygen	50
NO glucose or oxygen	0
With glucose but NO oxygen	0

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What do you conclude from the data given in the graph and table opposite? [4]
Give a full explanation of your conclusion.

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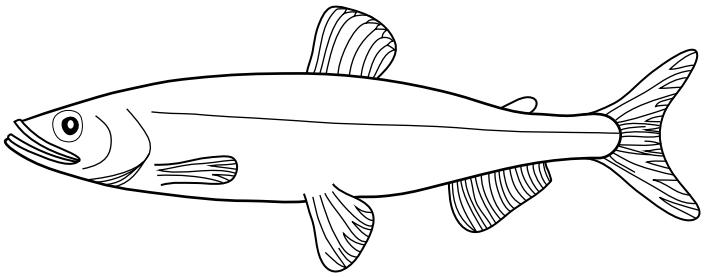
9. In South Wales, a population of fish called smelt *(Osmerus eperlanus)* live in a lake, into which runs a stream.

Smelt, *Osmerus eperlanus*



An estimation of the population size of the smelt in the lake was made using a capture/recapture technique.

200 smelt were captured from one part of the lake and their tails were marked with a harmless blue dye. The marked smelt were then returned to the lake.

The next day, 200 smelt were again captured in the same part of the lake. 20 of these were found to have been marked with the dye and 180 were unmarked.

(a) Estimate the size of the population of smelt in the lake by using the formula [2]

$$\text{Population size} = \frac{\text{Number captured on first day} \times \text{number captured on the second day}}{\text{Number of marked smelt recaptured on second day}}$$

Show your working

Answer .....

(b) Which number, used in the formula, would be directly affected by emigration from the lake? [1]

.....

(c) Apart from emigration, suggest **three** *other* reasons why your estimate is unlikely to be an accurate indication of the actual population size of the smelt in the lake. [3]

(i) .....

(ii) .....

(iii) .....

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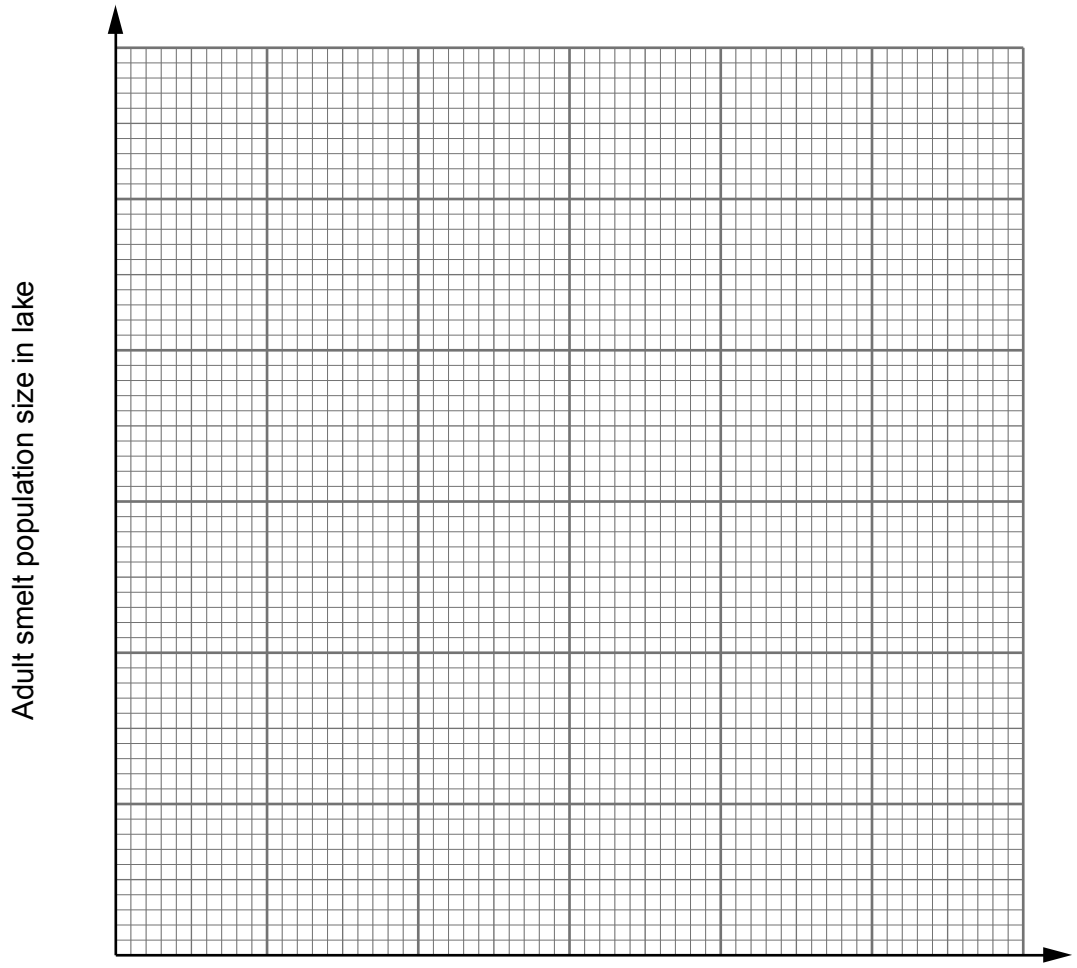
(d) Adult smelt begin to migrate from the sea into the fresh water lake in February to breed. They begin to migrate back to the sea in April.
Use the information above, to sketch a line graph, on the grid below, showing the expected change in the size of the population of adult smelt in a lake near an estuary over a period of a year.
Insert a scale on the horizontal axis showing the time in months. [2]



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Turn over for Question 10.

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10. Write an account of the similarities and differences between aerobic and anaerobic respiration in muscle cells. In your account, explain why aerobic respiration is more efficient than anaerobic respiration. [6 QWC]

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END OF PAPER

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