

Surname	Centre Number	Candidate Number
Other Names		0



GCSE

4471/02



S16-4471-02

ADDITIONAL SCIENCE/BIOLOGY

**BIOLOGY 2
HIGHER TIER**

P.M. TUESDAY, 17 May 2016

1 hour

For Examiner's use only		
Question	Maximum Mark	Mark Awarded
1.	5	
2.	5	
3.	4	
4.	4	
5.	6	
6.	6	
7.	7	
8.	3	
9.	8	
10.	6	
11.	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.

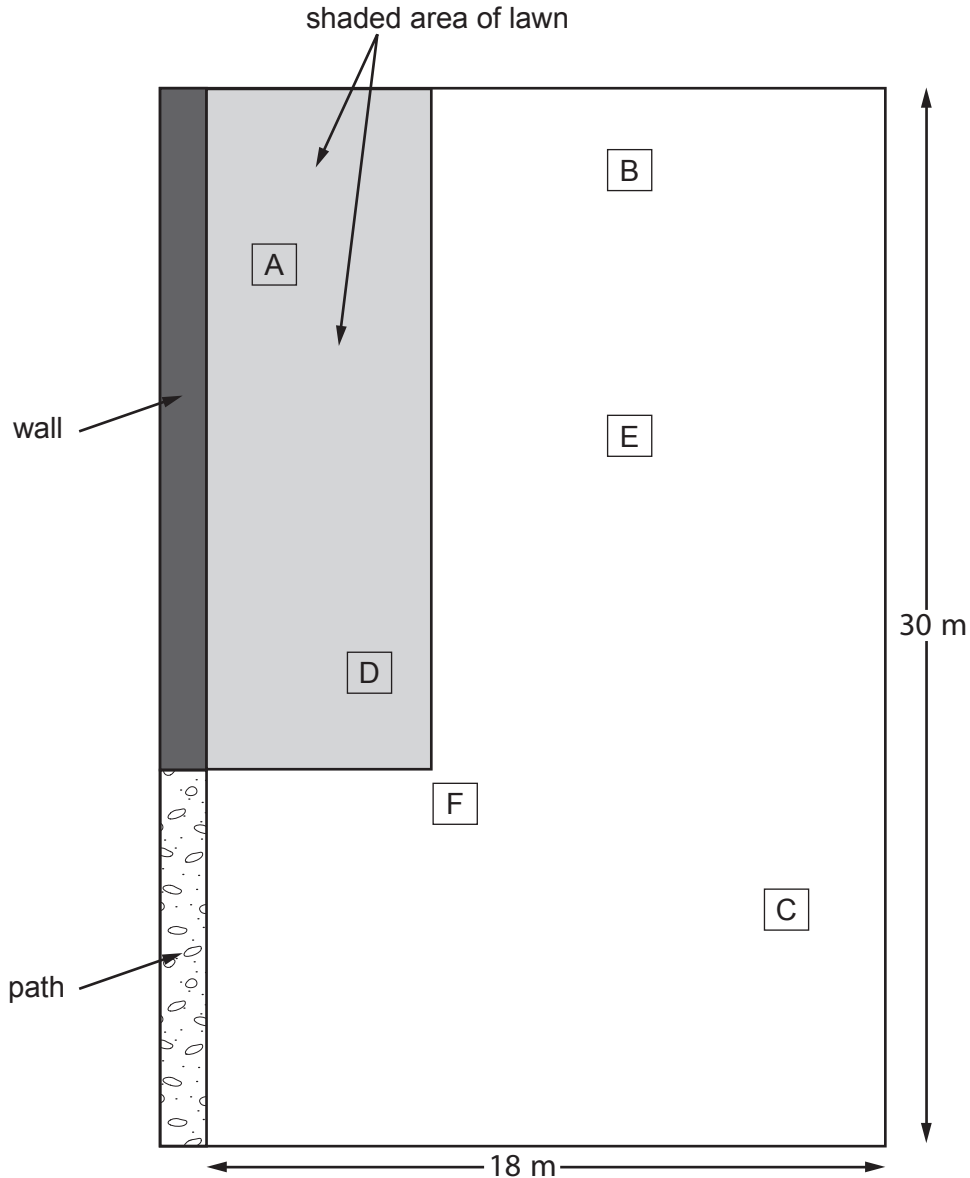
INFORMATION FOR CANDIDATES

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 question **5** and question **11**.

Answer **all** questions.

1. Some students investigated the number of dandelion plants on a lawn. The diagram shows the lawn and the location of 6 quadrats (A to F) which the students had placed at random on the lawn.



Key: quadrat

The students counted the number of dandelions in each quadrat and recorded their results in the table below.

quadrat	number of dandelions
A	7
B	2
C	1
D	6
E	2
F	0

- (a) Each quadrat measured 1 m².
Calculate the mean number of dandelions per square metre for the 6 quadrats. [1]

Mean number of dandelions =

- (b) Calculate the area of the lawn. [1]

Area of lawn =

- (c) Use your answers from parts (a) and (b) to estimate the total number of dandelions on the lawn. [1]

Estimated total number of dandelions =

- (d) In fact, the **actual** number of dandelions on the lawn is 1 250.
Use the formula below to calculate the percentage error of the estimate in part (c) above. [1]

$$\text{percentage error} = \frac{\text{estimated number of dandelions} - \text{actual number of dandelions}}{\text{actual number of dandelions}} \times 100$$

percentage error = %

- (e) How could the strength of evidence in the investigation be improved? [1]

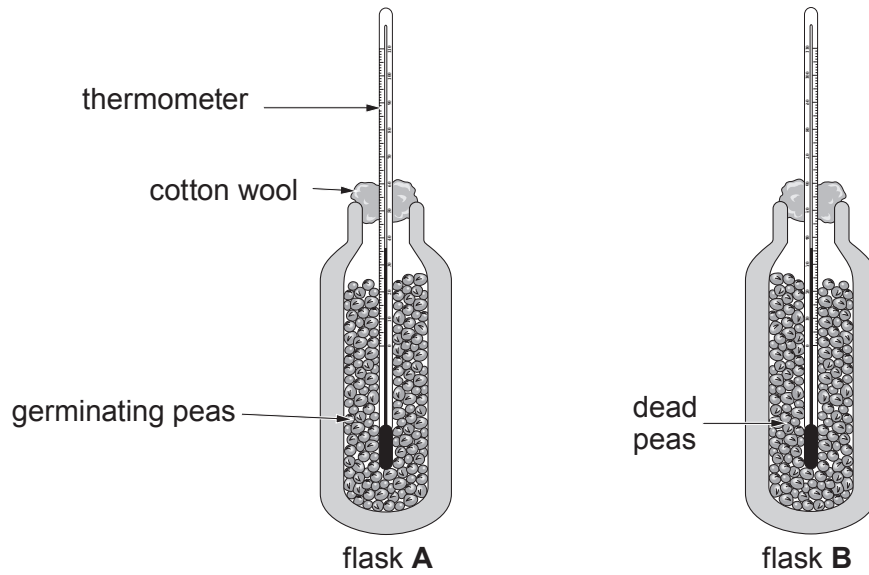
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2. Dan and Beth investigated the heat released by germinating peas.

The diagram below shows their experiment.



(a) The temperature of the peas in each flask was recorded at the start of the experiment and after two days. The results are shown in the table below.

flask	temperature (°C)	
	start	after two days
A	21	28
B	21	21

Describe and explain the results for **both** flasks.

[3]

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(b) The students did not disinfect the peas before setting up the experiment. Explain the importance of disinfecting the peas in order to make a valid conclusion. [2]

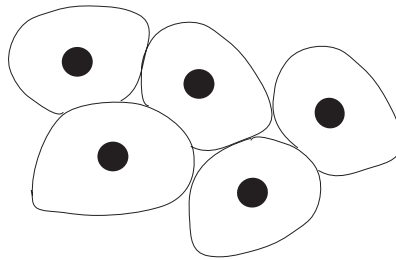
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3. (a) The drawing below shows human embryonic stem cells.



What features of stem cells could make them useful in treating many different medical conditions? [2]

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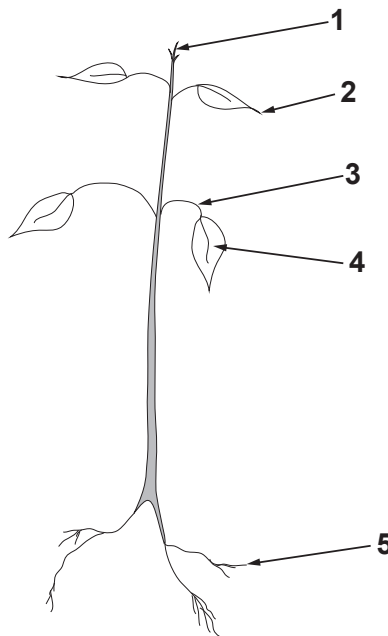
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(b) A laboratory in Japan has recently developed stem cells from human adult skin cells. Suggest why using human adult stem cells might be preferred to using human embryonic stem cells. [1]

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(c) Plants also have stem cells.



Which **two** numbered parts (1 to 5) of the plant shown above contain stem cells? [1]

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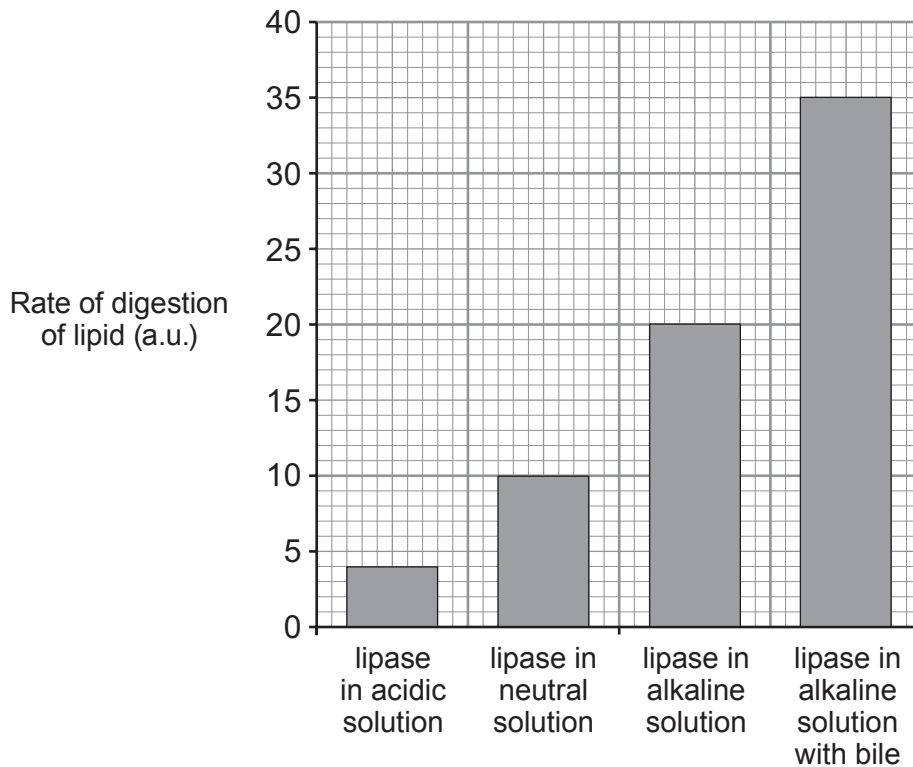
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4. (a) Why do we need to digest large food molecules? [1]

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(b) The graph below shows the rate of digestion of lipids by lipase under different conditions.



(i) Describe the effect of pH on the rate of digestion of the lipids. [1]

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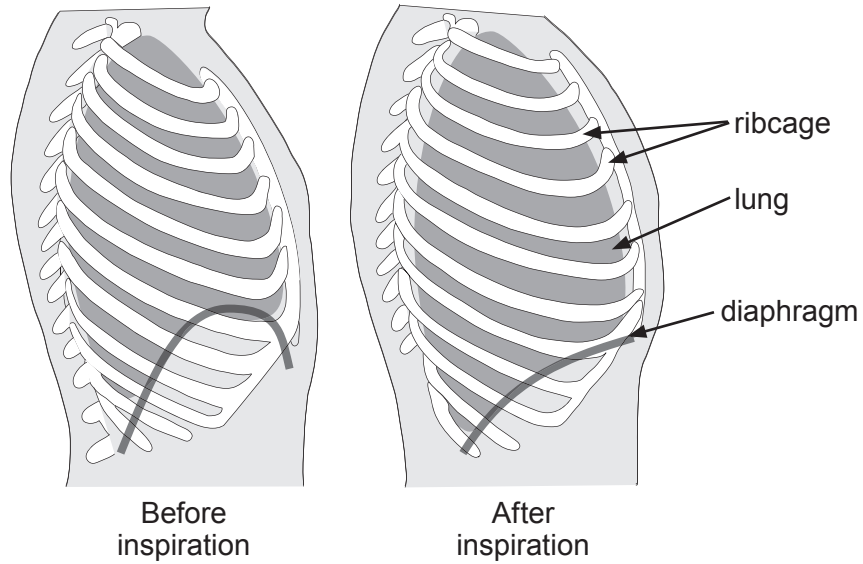
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(ii) Explain the effect of bile on the rate of digestion of the lipids. [2]

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5. The diagrams below show side views of the chest cavity before and after inspiration (breathing in).



Using both diagrams, explain how the movements of the **diaphragm and ribcage** bring about inspiration (breathing in). [6 QWC]

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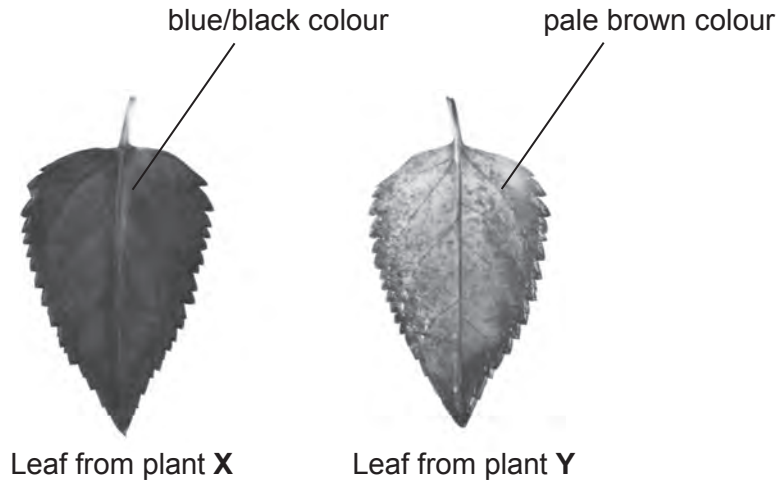
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6. (a) Complete the word equation for photosynthesis.

[2]

..... + → glucose +

(b) A leaf from each of two plants (**X** and **Y**) was tested for the presence of starch using iodine solution.
The results are shown in the diagrams below.



Plant **X** had been growing in the light before testing. Plant **Y** had been taken from the light and placed in the dark for 48 hours before the test.
Explain the results for both leaves.

[4]

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7. The relative masses of bases in DNA, in three different animals, are shown in the table.

source of DNA	mass of base /a.u.			
	adenine	guanine	thymine	cytosine
human	30.9	19.9	29.4	19.8
salmon	29.7	20.8	29.1	20.4
sheep	29.3	21.4	28.3	21.0

- (a) How do the data above give evidence for base pairing? [2]

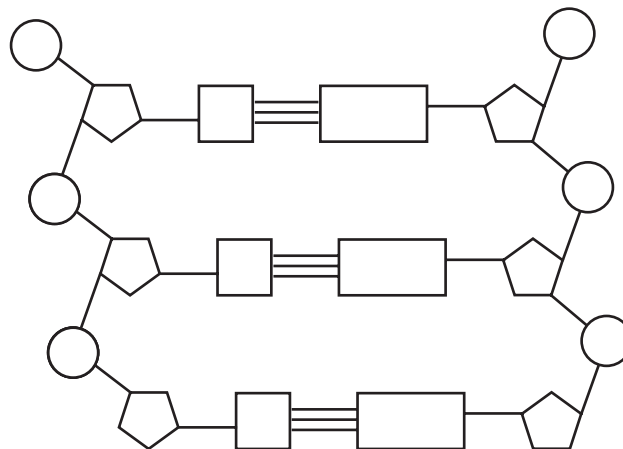
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- (b) The diagram below shows part of a DNA molecule.
Add labels to this diagram to show the position of: [2]

- (i) the sugar and phosphate molecules;
(ii) a base molecule.



- (c) Scientists have discovered a gene which, when defective, causes a genetically inherited disease. The normal gene controls the production of an essential protein. The relevant base sequence in the normal gene is:

TAGTAGAAACCACAA

The relevant base sequence in the gene of people with the genetically inherited disease is:

TAGTAGCCACAA

Explain why the DNA in people with the genetically inherited disease will not be able to produce the essential protein. [3]

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8. The table below shows the concentration of lactic acid in the blood of two athletes, Anjum and Tudor, before and after vigorous exercise that lasted 10 minutes.

The concentration of lactic acid was measured at 10 minute intervals after the exercise for the next 50 minutes.

time (min)	lactic acid concentration (mg / 100cm ³)	
	Anjum	Tudor
0	20	20
10	80	90
20	78	90
30	60	80
40	50	75
50	38	60
60	25	50

- (a) Use the data to give reasons why Anjum appears to be fitter than Tudor. [2]

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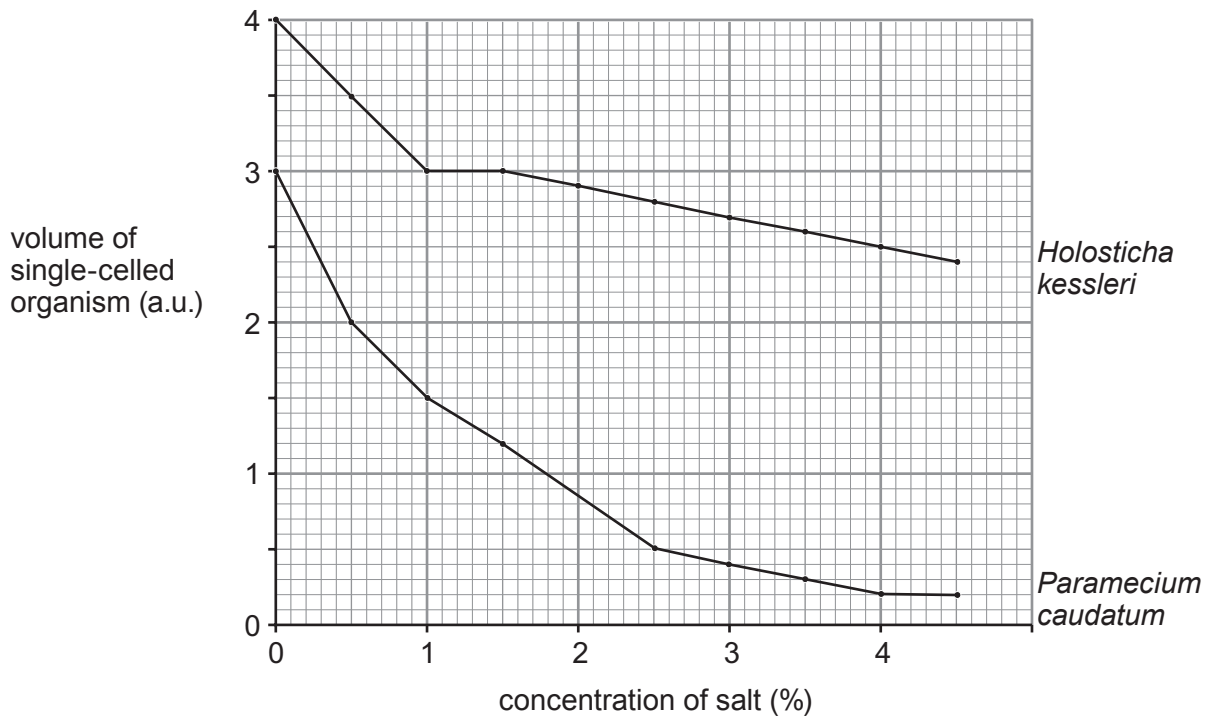
- (b) Give a reason why a marathon runner relies almost totally on aerobic respiration and produces very little lactic acid. [1]

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9. An investigation into the role of cell membranes in diffusion was carried out using two similar species of single-celled organisms, *Paramecium caudatum* and *Holosticha kessleri*. Both species were the same volume (3 a.u.) at the start of the investigation. The two species were then placed in water containing different concentrations of salt for 30 minutes. The volumes of the single celled organisms were then measured again using a microscope fitted with a microscale. The results are shown in the graph below.



- (a) How do the graphs provide evidence that
- (i) *Paramecium caudatum* cannot live in sea water? [1]

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- (ii) *Holosticha kessleri* normally lives in salt solutions of concentration between 1% and 1.5%? [1]

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- (b) State **two** factors that should have been kept constant during this investigation for it to have been a fair comparison. [2]

(i)

(ii)

(c) State the name of the type of diffusion taking place and explain fully how it affects *Paramecium caudatum* in sea water. [4]

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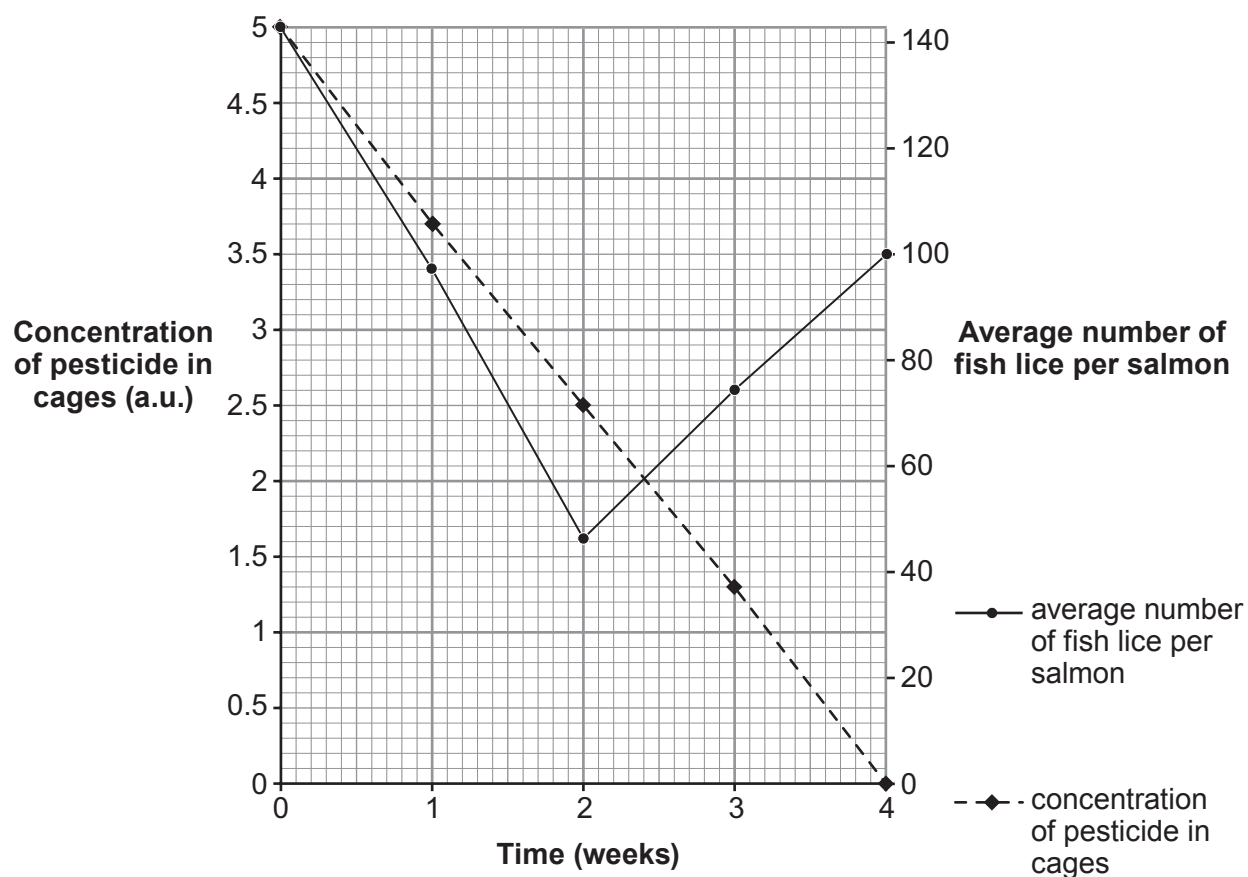
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10. Farmed salmon are kept in large numbers in sea cages. They are often infested by small invertebrate pests called fish lice.



fish louse

Fish lice damage the skin of the salmon and sometimes kill them by affecting the gills and brain. Fish farmers add pesticides to the sea cages to kill the fish lice. The graph shows the concentration of pesticide in cages and the average number of fish lice per salmon over a period of four weeks.



(a) What conclusions can be drawn from this graph?

[2]

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(b) The goldsinny wrasse, *Centrolabrus rupestris* eats fish lice.



In the 1980s, trials called the Ecofish Project took place in some fish farms in Norway and Scotland. 600 goldsinny wrasse were added to sea cages containing 26 000 salmon. Over a four week period, these salmon did not need any treatment with pesticides but a control group had to be treated several times.

(i) What is the name given to this method of control using living organisms to kill a pest? [1]

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(ii) Before the goldsinny wrasse are used more widely, suggest **three** observations that would have to be made during extended trials. [3]

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II.

III.

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11. Write an account of some of the different methods of protecting endangered species of animals and plants around the world. Include the use of legislation in your answer. [6 QWC]

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