Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3400UB0-1

S18-3400UB0-1

BIOLOGY – Unit 2:
Variation, Homeostasis and Micro-organisms
HIGHER TIER

TUESDAY, 15 MAY 2018 – AFTERNOON

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**7**	
2.	**13**	
3.	**6**	
4.	**11**	
5.	**4**	
6.	**5**	
7.	**5**	
8.	**9**	
9.	**9**	
10.	**11**	
Total	**80**	

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01

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. Do not use gel pen. Do not use correction fluid.

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. If you run out of space, use the additional pages at the back of the booklet, taking care to number the question(s) correctly.

INFORMATION FOR CANDIDATES

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

Question **3** is a quality of extended response (QER) question where your writing skills will be assessed.

MAY183400UB0101

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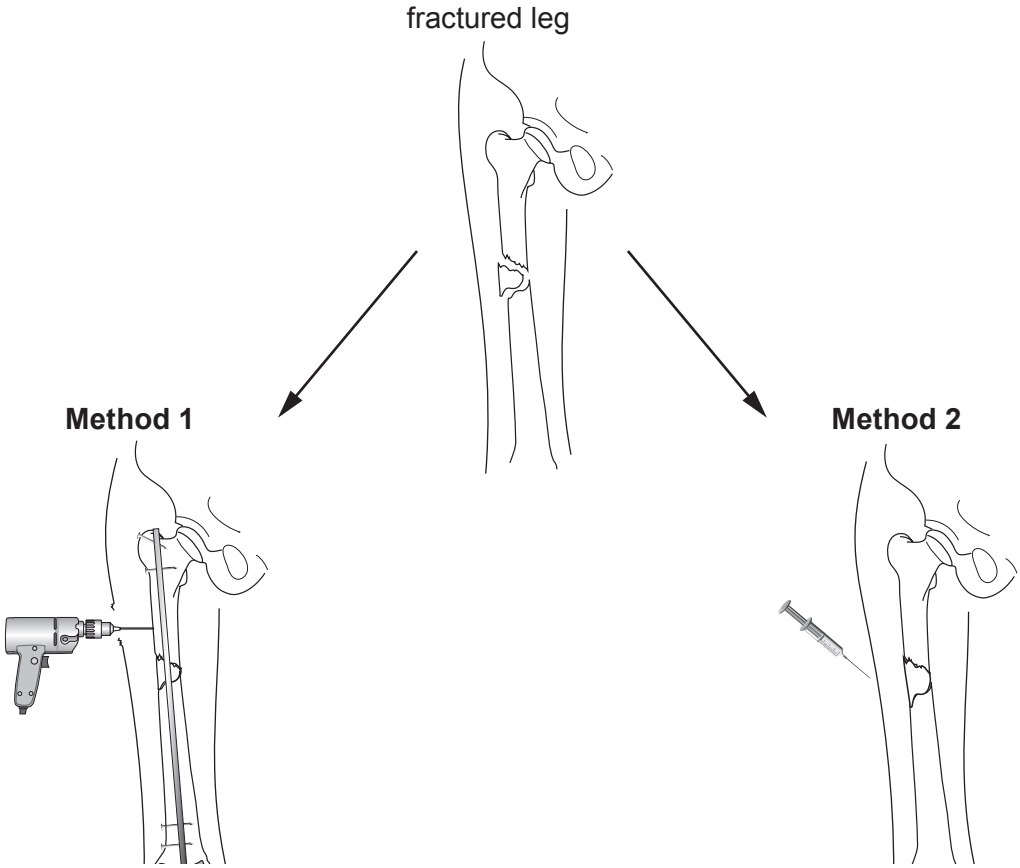
Answer **all** *questions*

1. The photograph below shows a young ice skater, Tracey, who falls and fractures her leg.

The diagram below shows two ways in which Tracey's fractured leg could be treated in a large modern hospital.



Traditional surgery using a permanent metal rod and screws.

It is possible to stand after 2 days.

A new process which involves injecting stem cells into fractured bone.

It is possible to stand after 3 weeks.

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Expected results of treatment

Time after treatment (weeks)	Percentage of bone healing (%)	
	Traditional surgery	Injection of stem cells
10	10	12
20	14	25
30	19	38
40	28	55
50	41	70
60	59	82

(a) Give **one** reason why Tracey might choose traditional surgery and **one** reason why, alternatively, she might prefer to be treated by an injection of stem cells. [2]

.....

.....

.....

(b) (i) When fractured bones heal, cells divide and multiply by mitosis.

Complete the table below. [2]

Mitosis in human cells	
chromosomes in mother cell	46
number of daughter cells produced after one division	.....
number of chromosomes in daughter cells	.....

(ii) Following mitosis, what must happen to stem cells, in order for them to repair the fractured bone? [1]

.....

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(iii) State the name of the disease that can occur if cell division by mitosis is uncontrolled. [1]

.....

(c) Stem cells can be obtained from both adults and embryos.

Give **one** reason why some people have a strong personal objection to the use of embryonic stem cells in medical research. [1]

.....

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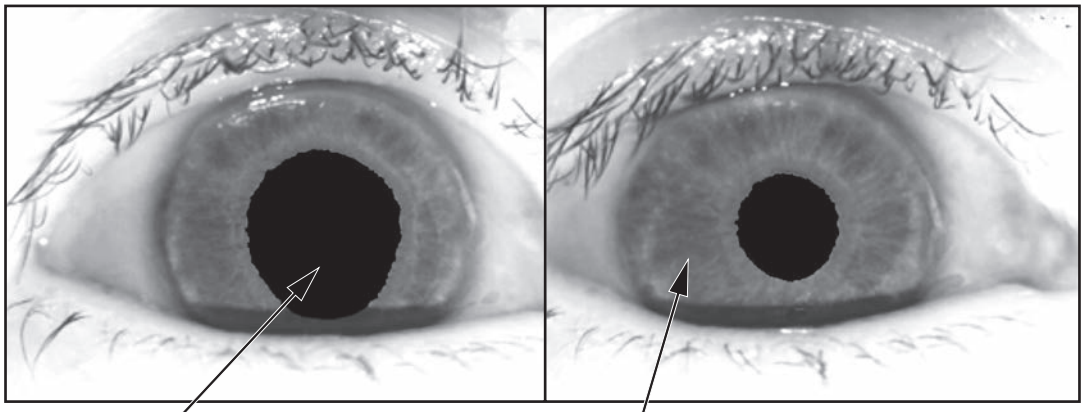
2. The photographs below show the appearance of an eye before and after a reflex action which occurs in response to a change in light intensity.

Before reflex action | After reflex action



A ..... **B** .....

(a) (i) Label **A** and **B** on the diagram. [1]

(ii) From the photographs, describe how **and** why parts **A** and **B** of the eye alter when the light intensity changes. [3]

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(iii) State **two** features of **all** reflex actions. [1]

.....

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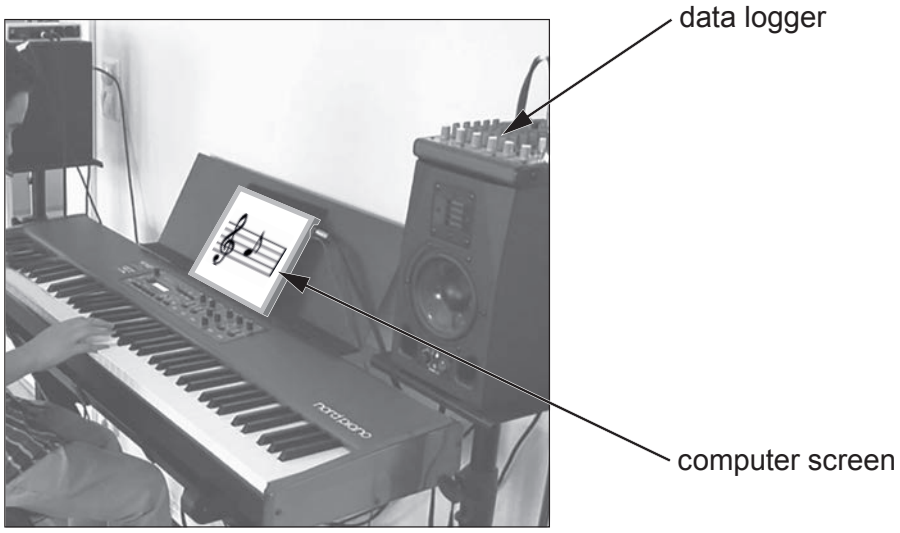
(b) Josie investigated reaction time in humans.

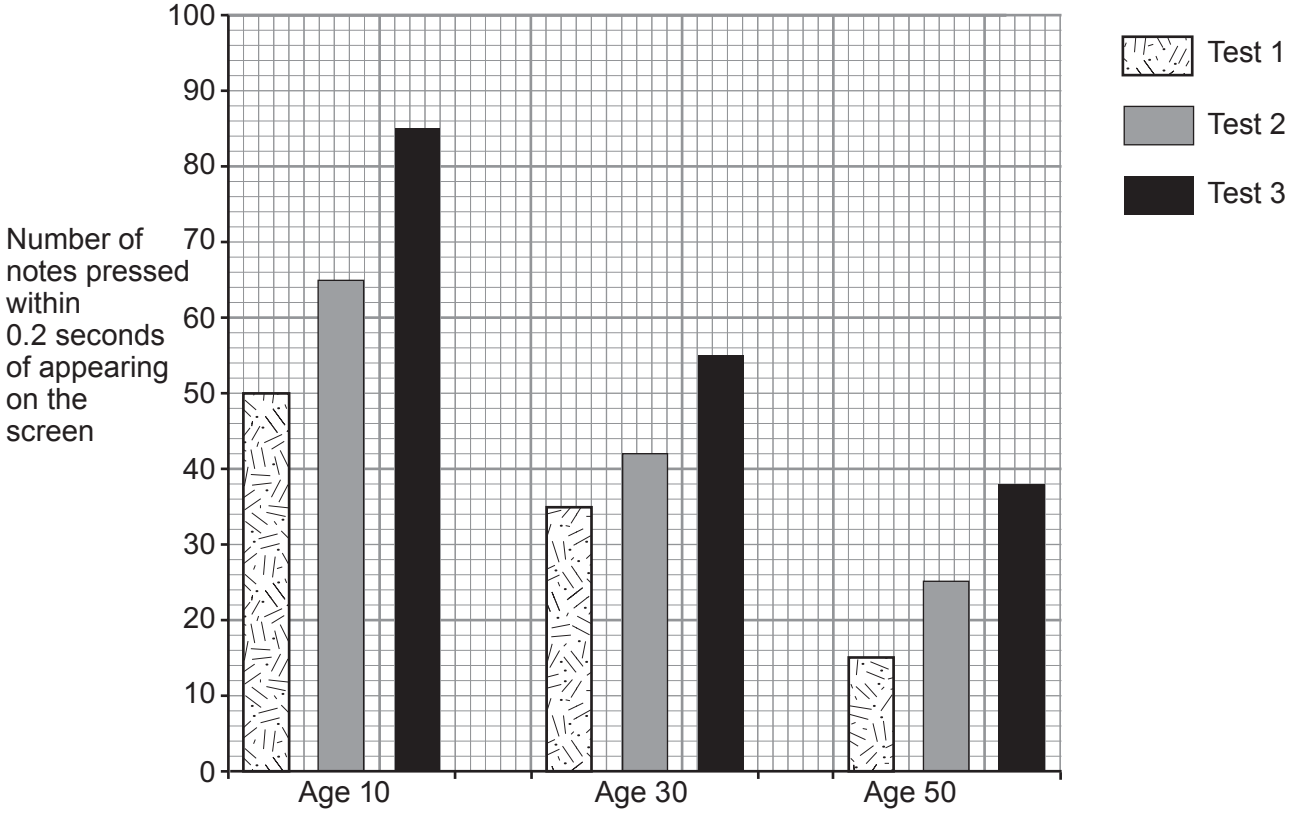
She tested three people, two males and one female of ages 10, 30 and 50 years old. They had between one and 20 years experience of playing the keyboard.

By means of a computer app, 90 random music notes flashed one by one onto a screen. The person being tested then instantly pressed each note on the keyboard as soon as it was seen. Each person did the test three times. No incorrect notes were pressed.

A data logger recorded the number of notes which were pressed within 0.2 seconds of appearing on the screen.



The bar chart shows the results of the investigation.



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Use the bar chart to answer the questions.

(i) How does repeating the test affect reaction time? [1]

.....

(ii) Calculate the percentage change between tests 1 and 2 for age 50. Give your answer to one decimal place. [2]

Percentage change = ... %

(iii) From the data, what **two** conclusions could you make about the effects of age on reaction time? [2]

.....

.....

.....

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(iv) I. Josie decided to try the investigation again and make it a fairer test of the effects of age. State **two** variables which she should control. [2]

.....

.....

II. State **one** *other* way in which the investigation could be improved. [1]

.....

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13

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3. Describe the structure and function of DNA (Diagrams will not be credited). [6 QER]

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4. Basiliximab is a monoclonal antibody used to suppress the immune system of kidney transplant patients. It works by preventing white blood cells from attacking the cells of donor organs and therefore reduces the probability of rejection.

(a) (i) Apart from rejection, state another disadvantage of kidney transplants. [1]

.....

(ii) Explain why and how white blood cells of the recipient would attack the cells of the donor organ therefore leading to rejection. [3]

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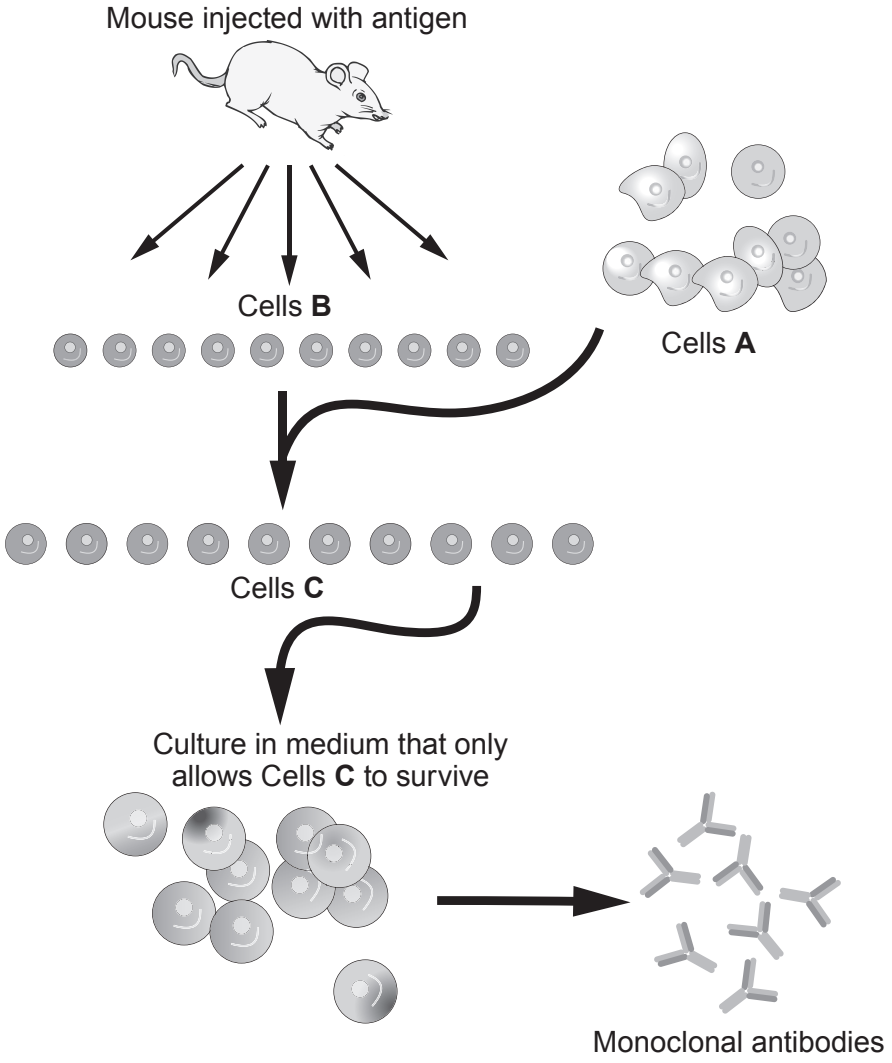
(b) The diagram below shows a process for producing monoclonal antibodies.



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Use the diagram and your own knowledge to answer the following questions.

State the name of the cells labelled:

(i) **A** ..... [1]

(ii) **B** ..... [1]

(iii) **C** ..... [1]

(iv) State how the following cells were produced: [2]

B .....

.....

C .....

.....

(c) State **two** *other* examples of medical uses for monoclonal antibodies. [2]

.....

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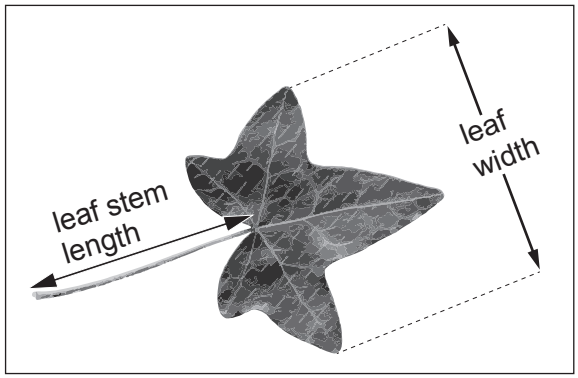
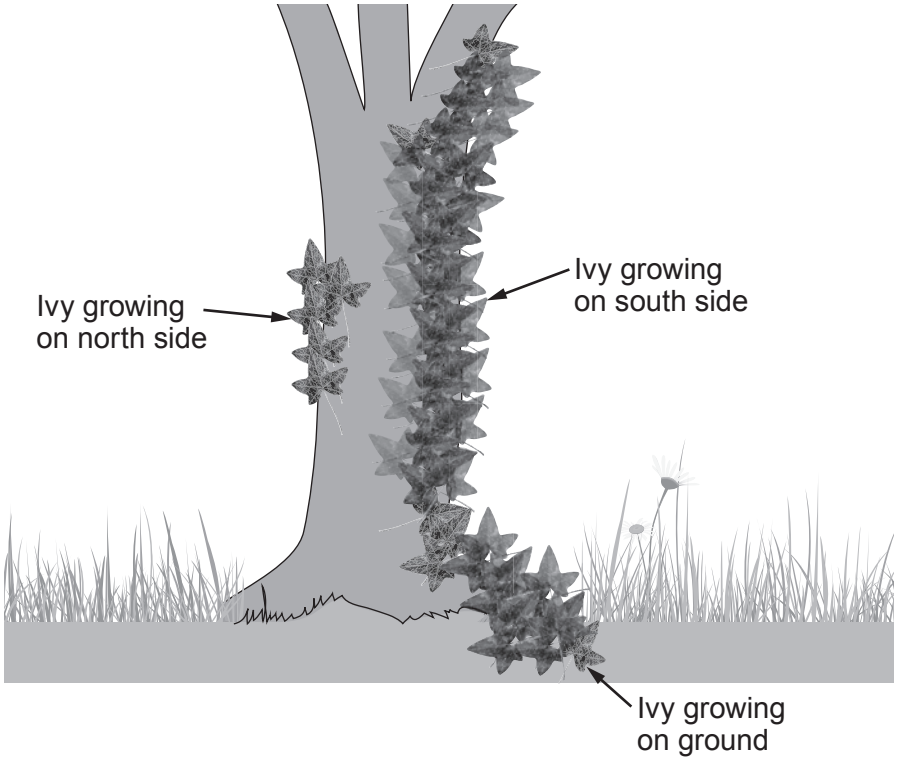
5. Students investigated factors affecting leaf growth of ivy *(Hedera sp.)*.

They measured the leaf stem length and the leaf width of 50 leaves of an ivy plant growing on the south side of a tree trunk at a height between one and two metres.





They compared these measurements with ivy leaves of the same ivy plant growing on the north side of the same tree trunk at the same height and also leaves from the same ivy plant growing flat on the ground.

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Their results are shown below:

	Leaves from ivy growing on the south side	Leaves from ivy growing on the north side	Leaves from ivy growing on the ground
Mean leaf stem length (mm)	63	60	42
Mean leaf width (mm)	55	52	38
Ratio of leaf stem length to leaf width	1·15 : 1	..... :	1·11 : 1

(a) (i) Calculate the ratio of leaf stem length to leaf width for the ivy growing on the north side of the tree and **write your answer in the table**. [2]
SPACE FOR WORKING

(ii) Suggest why there is a difference between the ratio of leaf stem length to leaf width for the ivy growing on the ground and the ivy growing on the south side of the tree. [1]

.....

.....

(b) Students recorded the data for the ratio in the frequency table below.

Ratio	South facing	North facing	Ground growing
0.51 - 0.75	7	4	4
0.76 - 1.00	9	7	13
1.01 - 1.25	15	27	24
1.26 - 1.50	13	9	7
1.51 - 1.75	3	5	2
1.76 - 2.00	0	0	0

State the type of variation shown by the ratio. [1]

.....

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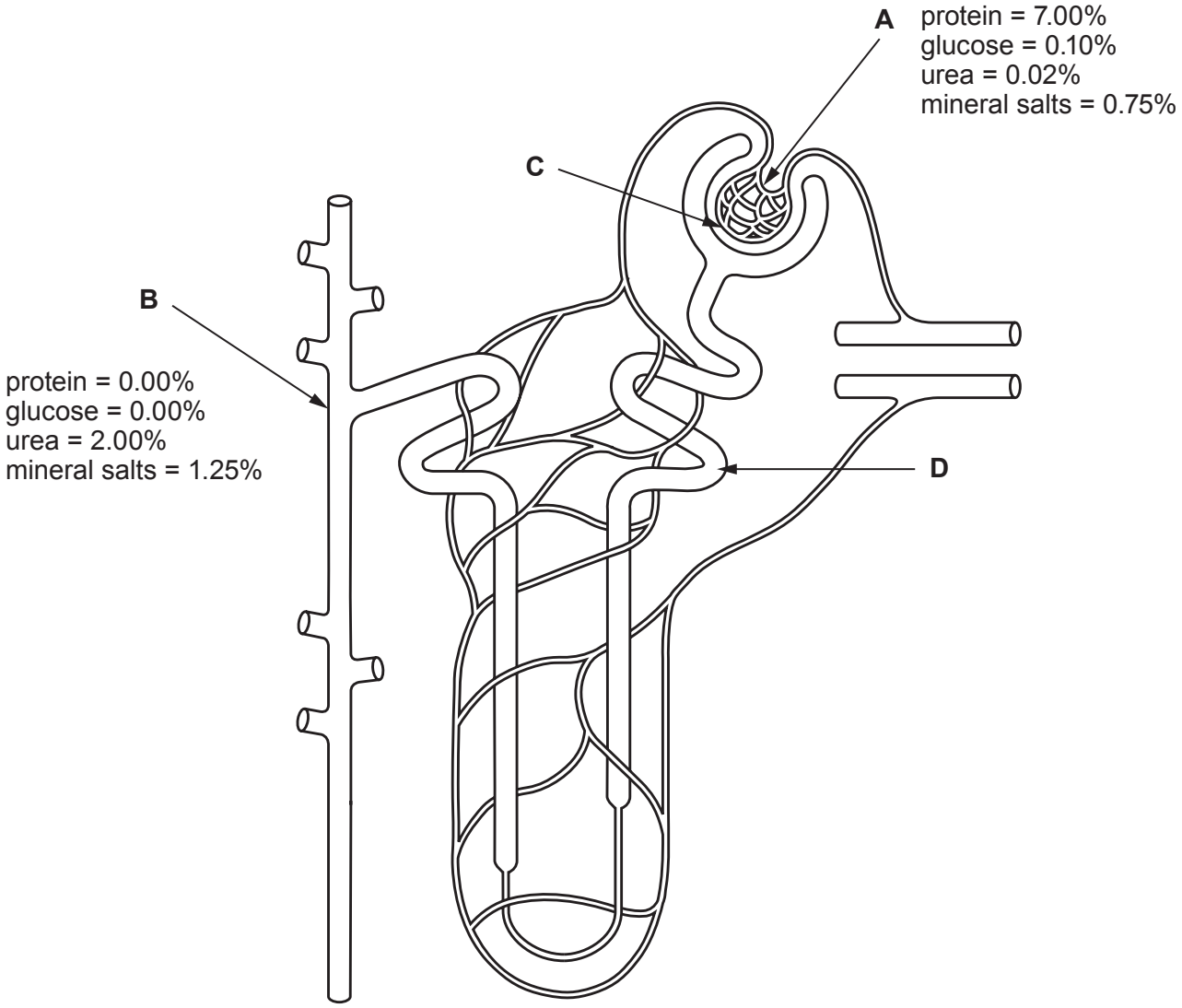
6. The diagram below represents a human nephron. The concentration of various substances is shown at two different points, **A** and **B**.



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(a) Use the diagram and your own knowledge to answer the following questions.

(i) Name and describe the process occurring at point **C**. [2]

.....

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.....

(ii) Explain why the concentration of glucose is different at points **A** and **B**. [1]

.....

.....

.....

(iii) State the name of structure **D**. [1]

.....

(b) State a reason for the increase in the concentration of urea and mineral salts between points **A** and **B**. [1]

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7. Some students investigated the tropic responses of the dandelion *(Taraxacum officinale)*.

(a) State what is meant by tropic responses. [1]

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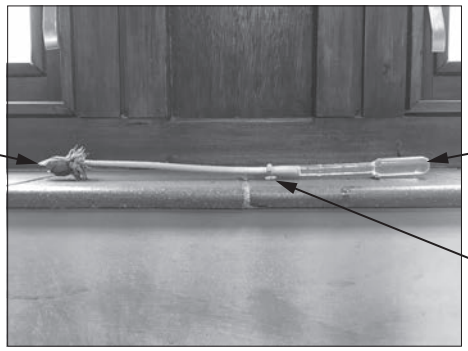
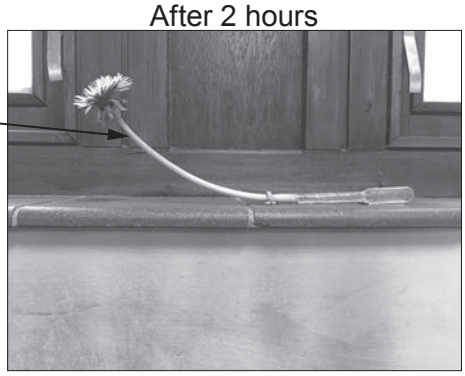
.....

(b) The students set up the apparatus shown below on a south-facing window-sill.



After 2 hours



The students concluded that the dandelion had shown positive phototropism.

Suggest why the students cannot be confident in their conclusion. Explain how they could change the method to improve confidence in their conclusion. [3]

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(c) State the name of the plant hormone responsible for phototropism. [1]

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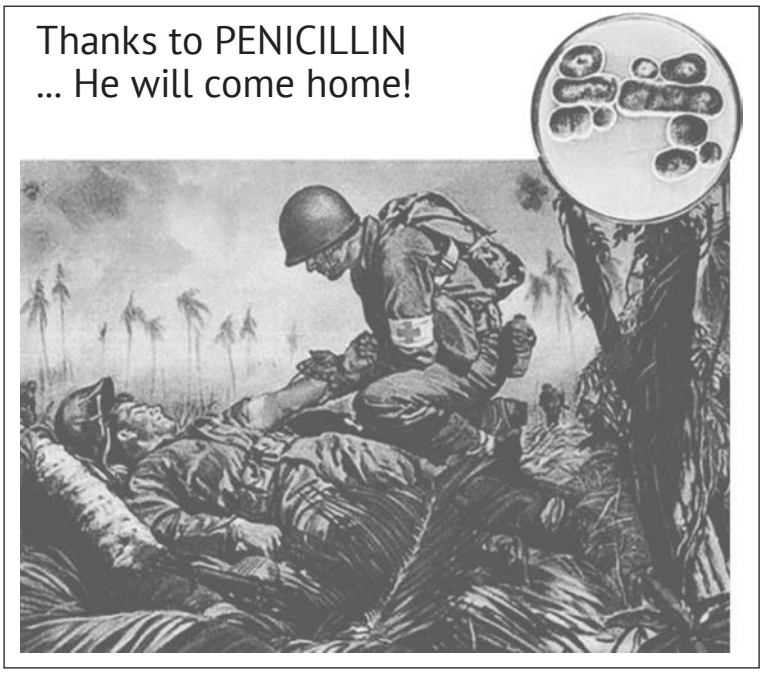

Penicillin is an antibiotic that is produced by several species of a fungus from the genus *Penicillium*. Its effect was first identified by Alexander Fleming in 1928. It was only in 1939 that Penicillin was extracted by Howard Florey and Ernst Chain at Oxford University and later developed for use as an antibiotic. The industrial scale production of penicillin was developed in the USA between 1941 and 1943 in response to the high number of soldiers who were dying due to diseases linked to their wounds during World War II.

Penicillium can be grown industrially in a tank called a fermenter. An example is shown in the diagram opposite:

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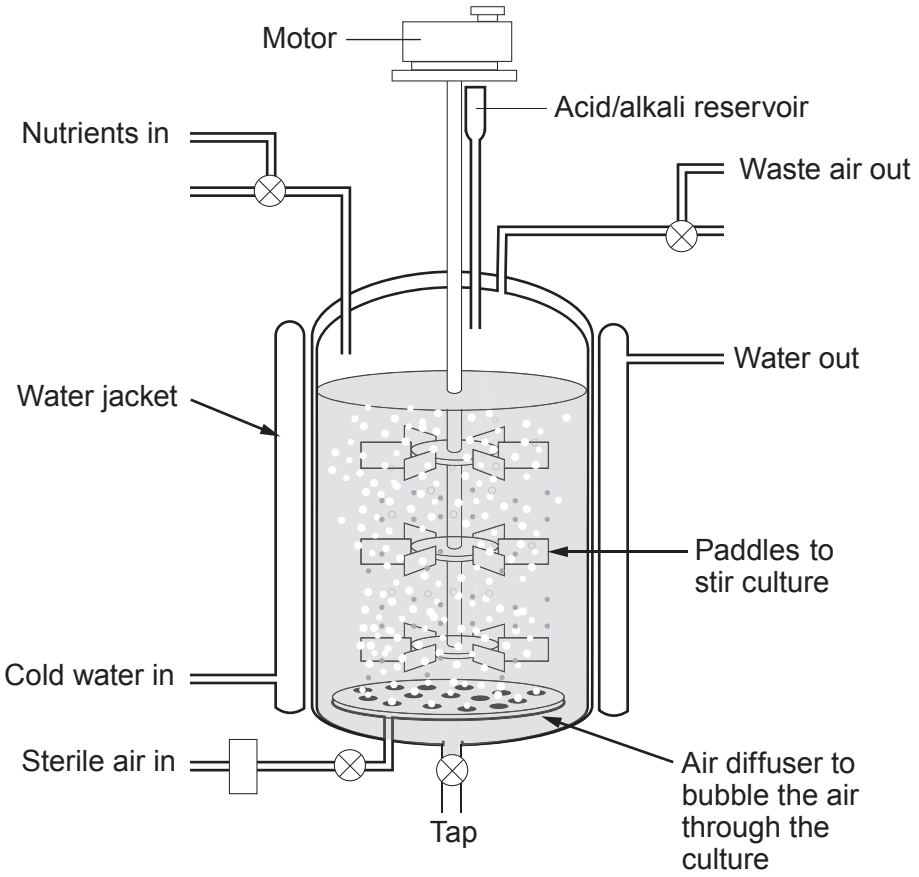

(a) (i) State how penicillin helped save the lives of wounded soldiers. [1]

.....

.....

(ii) Name a group of microorganisms that would not be affected by antibiotics. [1]

.....

(iii) State a danger of new drug treatments. [1]

.....

(b) Use the diagram of the fermenter and your own knowledge to answer the following question.

Other than nutrients, state **one** factor that affects the growth of *Penicillium* and state how it can be controlled by the fermenter. [1]

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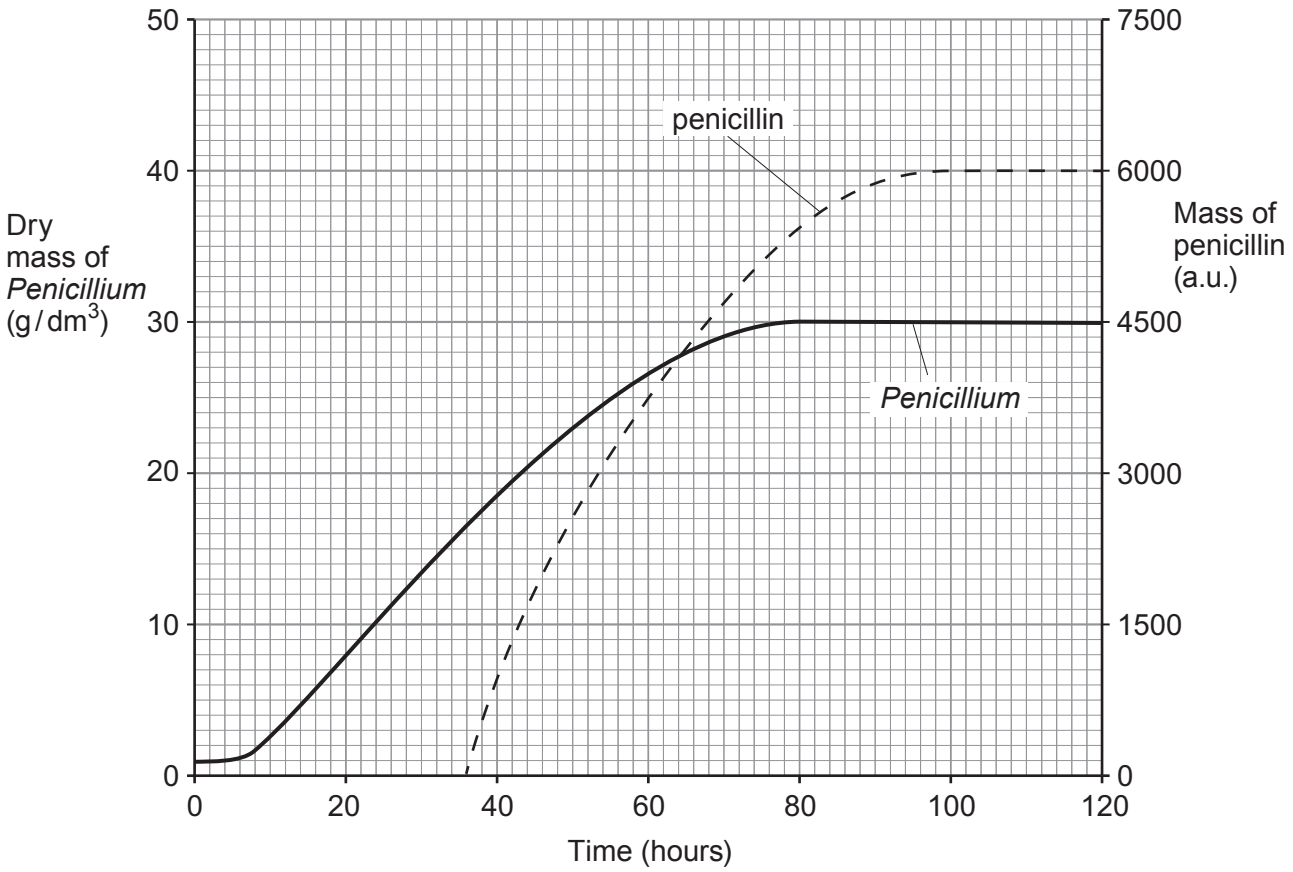
(c) The graph below shows the quantity of penicillin and *Penicillium* inside the fermenter at 25°C over a period of time:



Using the graph:

(i) Calculate the mean growth rate of *Penicillium* between 20 and 50 hours. [2]

Growth rate = ... g / dm^3 / hour

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(ii) Identify the optimum time for the penicillin to be extracted from the fermenter and justify your answer. [2]

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(d) **Draw a line on the graph** to estimate the effect of increasing temperature from 25°C to 28°C on the dry mass of *Penicillium* produced between 0-120 hours. [1]

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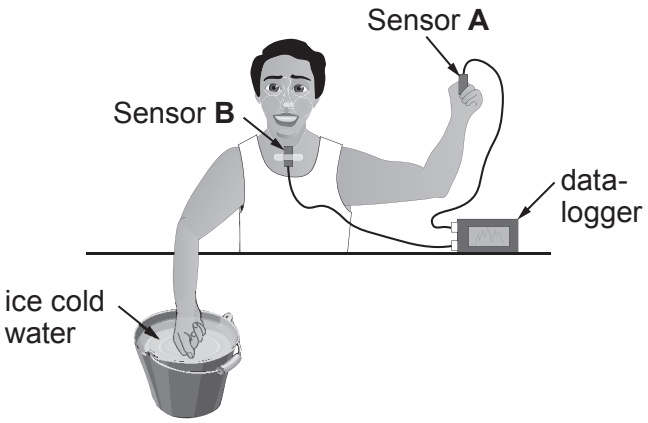
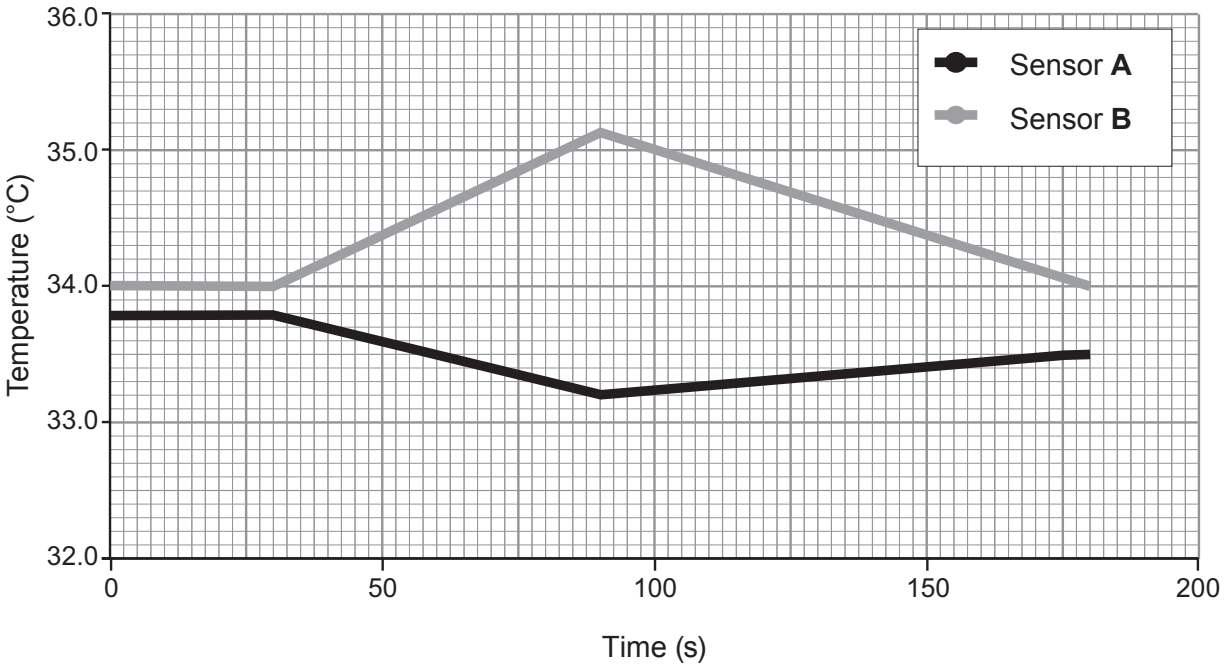
9. Dylan set up an experiment to study negative feedback mechanisms associated with rapid cooling of the hand.

A temperature sensor was held between the fingertips of a volunteer and another sensor was taped to the skin on the upper chest. The sensors were connected to a data logger that was set to record for three minutes.



The volunteer placed their right hand into ice cold water 30 seconds after the recording started. The hand was then removed from the ice cold water after a further 30 seconds.

The results from the data logger are shown below:



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(a) State what is meant by a negative feedback mechanism. [2]

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(b) (i) Describe the results for sensor **A** after the hand was placed in the ice cold water. [1]

.....

(ii) Explain the change in temperature recorded by sensor **A** between 30 seconds and 90 seconds. [4]

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(c) Suggest the reason for the increase in the temperature recorded by sensor **B** between 30 seconds and 90 seconds. [1]

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(d) Suggest how the results of the experiment would differ if the volunteer had consumed an alcoholic drink 20 minutes before the start of the experiment. [1]

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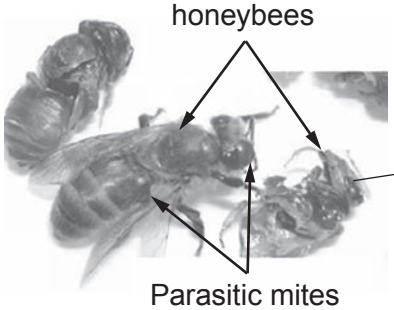
10. *Varroa destructor* is a parasitic mite of honeybees. A colony of honeybees affected by the parasite becomes weakened and eventually dies out. The parasitic mite originated in Asia, where it is a pest of the Asian honeybee, *Apis cerana*. It has spread across most continents, arriving in the UK in the early 1990s and affecting the native European honeybee, *Apis mellifera*.



(a) Use your knowledge of classification to suggest why the parasitic mite was able to spread from the Asian to the European honeybee. [2]

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In 2014-2015 there were 1650 registered beekeepers in Wales who kept bee colonies, each of which is one beehive. The National Bee Unit recommends that honeybees should be treated with pesticides to try and reduce the numbers of the parasitic mite in beehives.

In recent years many beekeepers in North West Wales have stopped treating their bees with pesticides. These beekeepers believe that there is no difference in colony losses between bees treated with pesticides and bees not treated with pesticide.

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The table below shows Winter Losses (the number of colonies that died out) between 2010-2015 in North West Wales.

Season	Number of beekeepers in the survey		Total number of colonies	Number of treated colonies	% winter loss in treated colonies	Number of colonies not treated	% winter loss in not treated colonies
	Treating	Not treating					
2010-2011	10	5	71	44	27	27	11
2011-2012	11	31	355	180	8	175	7
2012-2013	8	46	251	75	41	176	32
2013-2014	12	55	396	81	9	315	6
2014-2015	17	65	500	97	8	403	8

(b) What percentage of beekeepers in Wales took part in this survey in 2014-2015? [2]

percentage of beekeepers = ... %

(c) (i) Use the information in the table to state **one** conclusion about the effect of the pesticides on winter losses of bees. [1]

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(ii) Give **two** reasons why some beekeepers across the UK would argue that the strength of evidence in this survey is weak. [2]

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(d) Early attempts at control of the parasitic mite involved using the chemical, pyrethroid. By the late 1990s the parasitic mite developed resistance to the chemical and beekeepers were advised to use other chemicals to control the pest.

Explain why, over time, the pyrethroid chemical became less effective at killing the parasitic mite. [4]

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