Surname	Centre Number	Candidate Number
Other Names		0

GCSE

C400U10-1

S19-C400U10-1

BIOLOGY – Component 1
Concepts in Biology

FOUNDATION TIER

TUESDAY, 14 MAY 2019 – AFTERNOON

2 hours 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**9**	
2.	**11**	
3.	**8**	
4.	**12**	
5.	**9**	
6.	**13**	
7.	**20**	
8.	**8**	
9.	**14**	
10.	**16**	
Total	**120**	

C400U101
01

ADDITIONAL MATERIALS

In addition to this examination paper, you will 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.

The assessment of the quality of extended response (QER) will take place in question **8***(b)*.

Examiner only

Answer **all** *questions.*

1. The illustrations below show the organisms in a single food chain in a large lake. The total biomass for each type of organism is given.

Snails
4 500 kg

Pike
250 kg

Aquatic plants
45 000 kg

Minnows
500 kg

Beetles
800 kg

(a) Minnows feed on beetles.

(i) Calculate the percentage loss in biomass between the beetles and the minnows. [2]

Percentage loss = ...

(ii) State **one** reason for the loss of biomass. [1]

.....

Examiner only

(b) (i) Complete the diagram below to show **a pyramid of biomass** for all the organisms in this food chain.

Label the diagram with the **names** of the organisms and the **masses**. [2]

Aquatic plants

(ii) Identify

I. the producers; [1]

.....

II. a carnivore, giving a reason for your choice. [1]

.....

.....

(c) A farmer used a chemical substance to increase the yield of his crops in a field close to the lake.
Rain washed some of the chemical into the lake. This caused the growth of the aquatic plants to increase greatly.

(i) State the type of chemical substance the farmer used. [1]

.....

(ii) Explain why the numbers of primary consumers would increase. [1]

.....

Examiner only

2. In the 1850s Gregor Mendel carried out scientific experiments with very large numbers of pea plants. He worked methodically and used statistical tests on his results.

Mendel proposed the ideas of inheritance which are accepted today. He said that *factors*, which we now call genes, occurred in pairs.

In 1865 he gave lectures to a scientific society and he published articles about his ideas in 1866. His work however was not appreciated until 1900, when others carried out similar experiments with similar outcomes.

In 1886 scientists first observed pairs of chromosomes in living cells under the microscope but the significance of this was not recognised at the time.

(a) Use the information to answer the questions.

(i) State the evidence that Mendel used a suitable sample size in his experiments. [1]

.....

(ii) State **one** method used by Mendel to communicate his ideas to others. [1]

.....

.....

(iii) Give the year in which Mendel's experimental results were found to be reproducible. Explain your answer. [2]

.....

.....

(iv) Explain how observations of cells in 1886 would have supported Mendel's ideas about what we now call genes. [2]

.....

.....

(b) Each human body cell has two sex chromosomes.

(i) State the sex chromosomes present in males and females. [2]

Males .....

Females .....

Examiner only

(ii) Complete the diagram below to show

I. the sex chromosomes present in the gametes of parents [1]

II. the sex chromosomes present in their offspring. [1]

Gametes		

(iii) From the diagram, state the probability of these parents having a female child. [1]

0%

25%

50%

75%

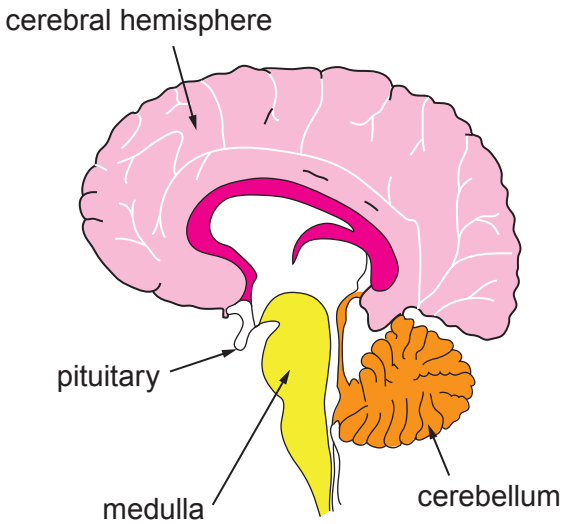
100%

Probability = ...

11

Examiner only

3. *(a)* Some parts of the brain shown in the diagram enable the gymnast in the photograph to perform her exercise.



parts of the brain

gymnast

Use the diagram and photograph to **complete the table**. [3]

Action in the gymnast's body	Part of the brain which controls the action
performing the sequence of moves in the correct order.	.....
.....	cerebellum
changing her heart rate automatically while she exercises.	.....

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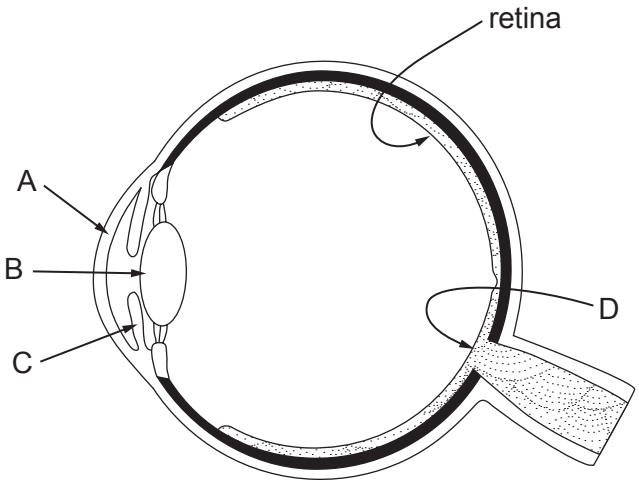
(b) The eye is one of the sense organs in the nervous system of the human body. The diagram below shows a section through a human eye.



On the diagram identify:

(i) the part which controls the amount of light entering the eye; [1]

Letter on diagram ..... Name .....

(ii) the part which changes shape to focus light onto the retina. [1]

Letter on diagram ..... Name .....

(c) Mary takes her driving test. She cannot see the number plate on a car parked some distance away without her glasses.

(i) State the name of Mary's eye defect which means she is unable to see distant objects clearly without her glasses. [1]

.....

(ii) Describe the cause of this defect and state the type of lens used in her glasses.[2]

.....

.....

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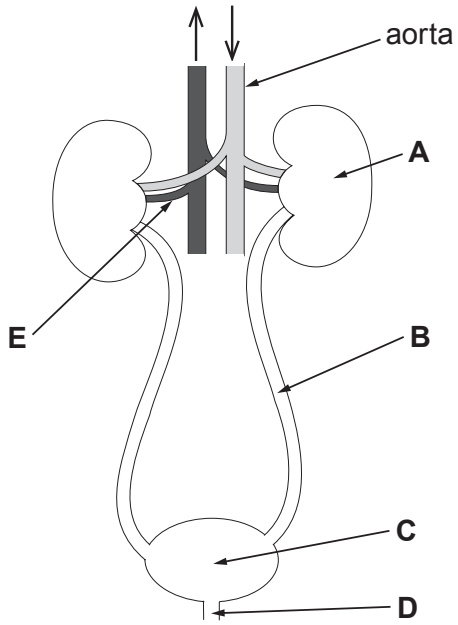
4. The diagram below shows the human excretory system.



(a) (i) State the letters which show: [1]

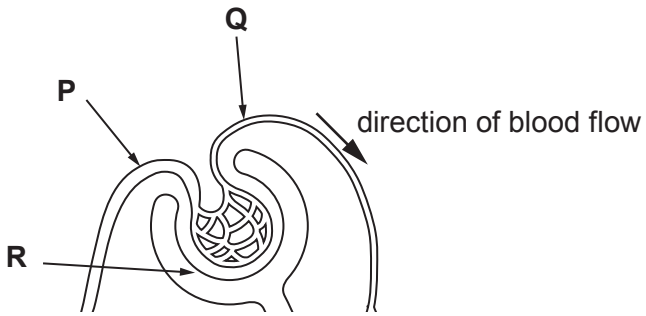
the ureter .....

the bladder .....

(ii) **Draw an arrow** on the diagram to label **one** renal artery. [1]

(b) Each kidney contains a large number of nephrons which filter the blood.

The diagram below shows part of one nephron where filtration occurs.



(i) Substances which are filtered out of the blood pass into structure **R**. State the name of structure **R**. [1]

.....

(ii) Blood vessel **P** is wider than blood vessel **Q**. Explain why this difference is important in the process of filtration. [1]

.....

.....

Examiner only

(c) Doctors investigated the concentrations of substances in the blood entering and leaving the kidneys of a patient who had been diagnosed with a medical condition. If their diagnosis was correct the patient would have protein in the urine but no glucose.

The table shows the results of the investigation.

	Concentration (a.u.)		
Substance	Blood entering kidney	Blood leaving kidney	Percentage removed by kidney (%)
Glucose	280	280	0
Protein	300	150	.....
Salts	310	260	16
Urea	187	15	92

(i) Calculate the percentage of protein removed by the kidney. **Write your answer in the table.** [2]

Space for working.

(ii) Using the data in the table, state the

I. substance which would appear in the urine in the largest proportion; [1]

.....

II. evidence that the doctors were correct in their diagnosis for this patient. [2]

.....

.....

(iii) Describe how a urine sample could be tested for the presence of protein and glucose.

I. protein [1]

.....

II. glucose [2]

.....

.....

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Examiner only

5. The human body maintains a constant internal environment even if conditions change. This is known as homeostasis.

(a) The body's hormonal system is important in responding to changes and maintaining a constant internal environment.

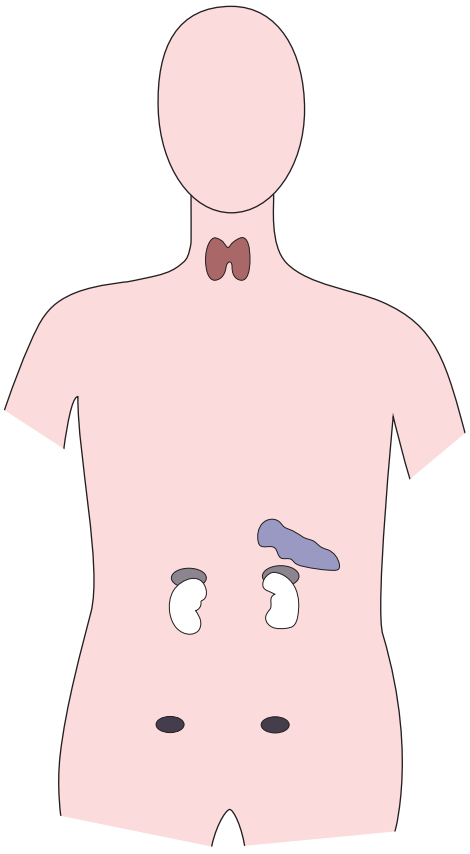
Describe how hormones travel to all parts of the body. [1]

.....

(b) The hormone insulin controls the concentration of glucose in the blood so that it normally remains within a range of 3.4 – 7.6 mmol / dm^3.

(i) The diagram below shows some of the hormone-producing glands of the human body.

Draw an arrow on the diagram to label and name the gland which produces insulin. [1]



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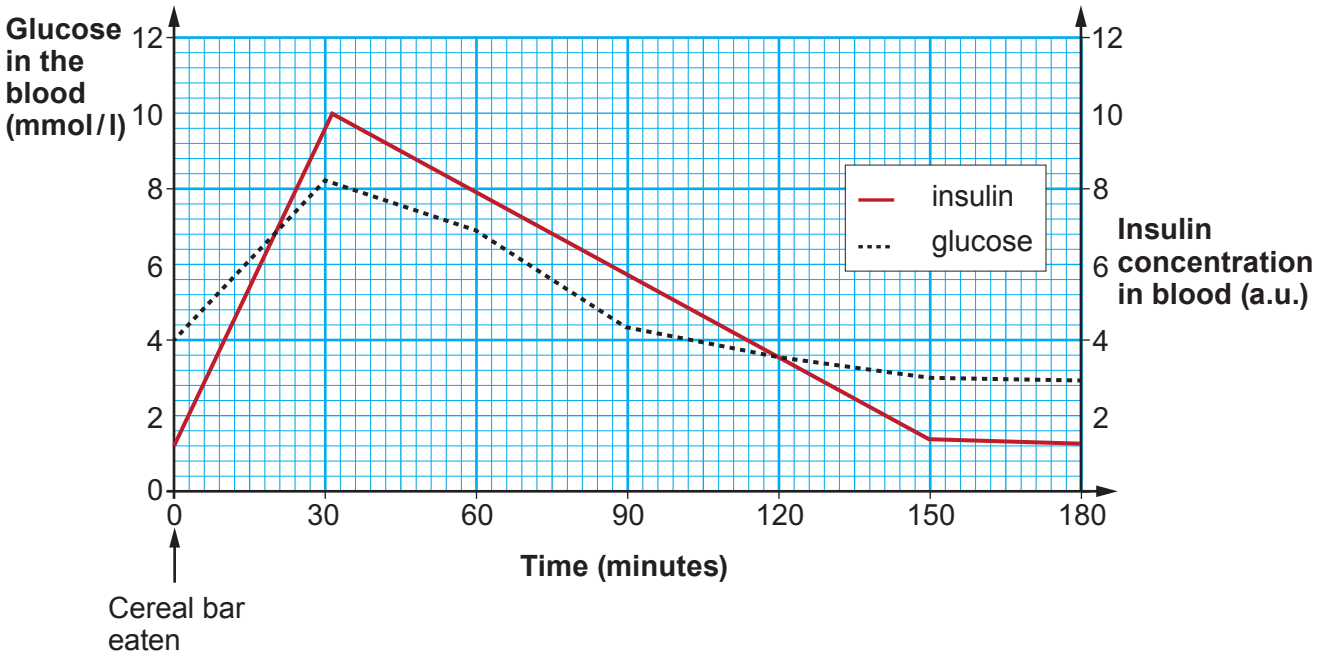
(ii) The graph shows the concentration of glucose and insulin in the blood of a person who has eaten a cereal bar.



Use the graph to answer the questions.

I. The cereal bar was free from sugars, including glucose. State which of the following could have caused the change in glucose concentration when the bar was eaten. [1]

A Fats

B Carbohydrates

C Protein

D Vitamins Answer letter .....

II. Give the evidence shown, that from 0 to 60 minutes, insulin reduces the concentration of glucose in the blood. [2]

.....

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Examiner only

III. Describe and explain the change in insulin concentration from 60 to 180 minutes. [3]

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.....

IV. From the list below identify the scientific term for the way in which insulin controls the concentration of glucose in the blood. [1]

A neutral feedback

B positive feedback

C negative feedback

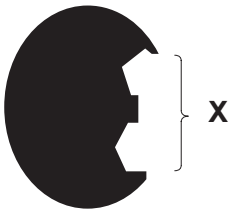
D hormonal feedback Answer letter .....

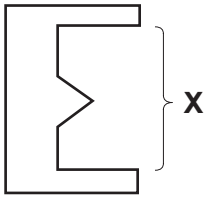
9

Examiner only

6. *(a)* Enzymes are protein molecules and each type has a specific shape.

The diagram shows two different enzymes.





(i) Explain what causes the shapes of the protein molecules to be different. [2]

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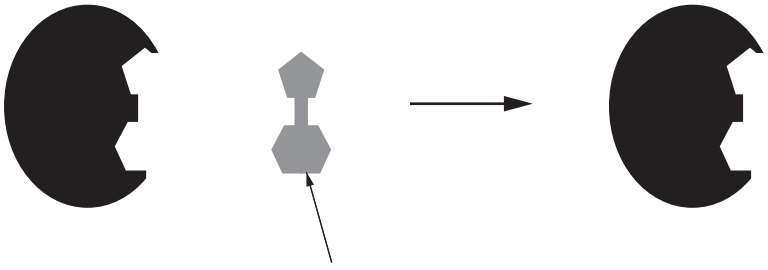
(ii) State the name of region **X** on the enzymes. [1]

.....

(iii) I. **Complete the diagram below** to show how an enzyme substrate complex is formed. [2]

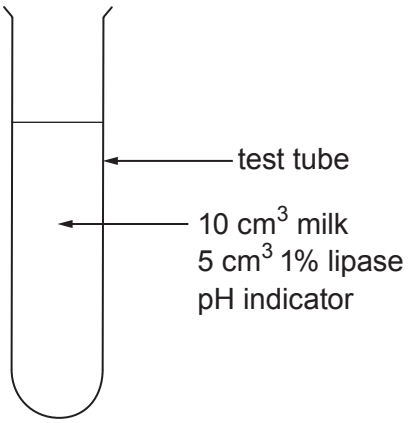


II. State the name of the model which describes enzyme action.

.....

Examiner only

(b) Students investigated the activity of the enzyme lipase on the digestion of the fat in milk at different temperatures. The students used the apparatus shown in the diagram.



They set up six test tubes at a range of temperatures between 10°C and 60°C for 30 minutes.

The pH indicator in the test tube changed colour as the pH in the tubes decreased and from this they could assess the activity of the enzyme. They carried out three tests at each temperature.

(i) Explain how the change in colour of the indicator solution was caused by the action of the lipase. [2]

.....

.....

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.....

The results of the investigation are shown in the table.

	Enzyme activity (a.u.)			
Temperature °C	Test 1	Test 2	Test 3	Mean
10	20	18	22	20
20	149	159	142	150
30	449	415	456	440
40	381	397	404	394
50	99	116	105	.....
60	27	23	28	26

Examiner only

(ii) Calculate the missing mean value for 50 °C and **write your answer in the table opposite**.

[2]

Space for working.

(iii) Describe the effect of increasing temperature on the activity of lipase. [2]

.....

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(iv) I. From these results, state the optimum temperature for lipase. [1]

.....

II. State how the investigation could be improved to identify the optimum temperature more accurately. [1]

.....

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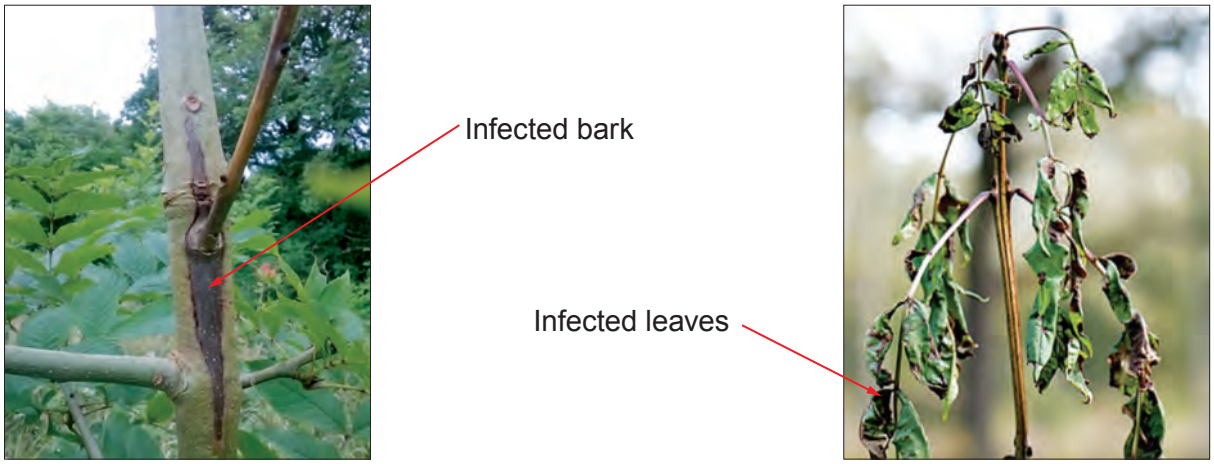
7. Ash trees *(Fraxinus sp.)* are native to all parts of the UK. They provide habitats for a wide range of other organisms.

The fungus *Hymenoscyphus fraxineus* causes die-back disease in ash trees. It was accidentally introduced into the UK from the Netherlands in 2012.

The fungus infects ash tree leaves. It then spreads rapidly destroying the branches and bark of the trees, most of which are killed.



The natural defences of older trees enable them to combat infection by the fungus. A few trees appear to have genes which make them resistant to the fungus.

There are no effective fungicides to control *Hymenoscyphus fraxineus*. Scientists are searching for a method of biological control.

(a) (i) State the scientific name of the micro-organism which causes die-back disease. [1]

.....

(ii) Describe **one** of the natural defences of leaves which enables them to avoid some infections. [1]

.....

.....

(iii) Select **two** of the following terms which describe *Hymenoscyphus fraxineus*. [1]

A an alien species

B an endangered species

C a native species

D a pathogenic species

Answer letters ..... and .....

Examiner only

(iv) Explain what is meant by the term the **biological control**. [2]

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(v) I. Describe how a selective breeding programme could be carried out to control ash die-back disease. [2]

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II. Explain why scientists have found it necessary to use selective breeding in controlling ash die-back disease. [1]

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.....

(vi) Explain why biodiversity will be reduced in future if ash die-back is not controlled. [2]

.....

.....

(b) Since 2013 scientists have monitored the incidence of ash die-back in the UK. Some of their results are shown below.

Year	Number of infected trees in monitored area	
	Wales	Scotland
2013	2	5
2014	5	7
2015	31	42
2016	62	115
2017	96	27

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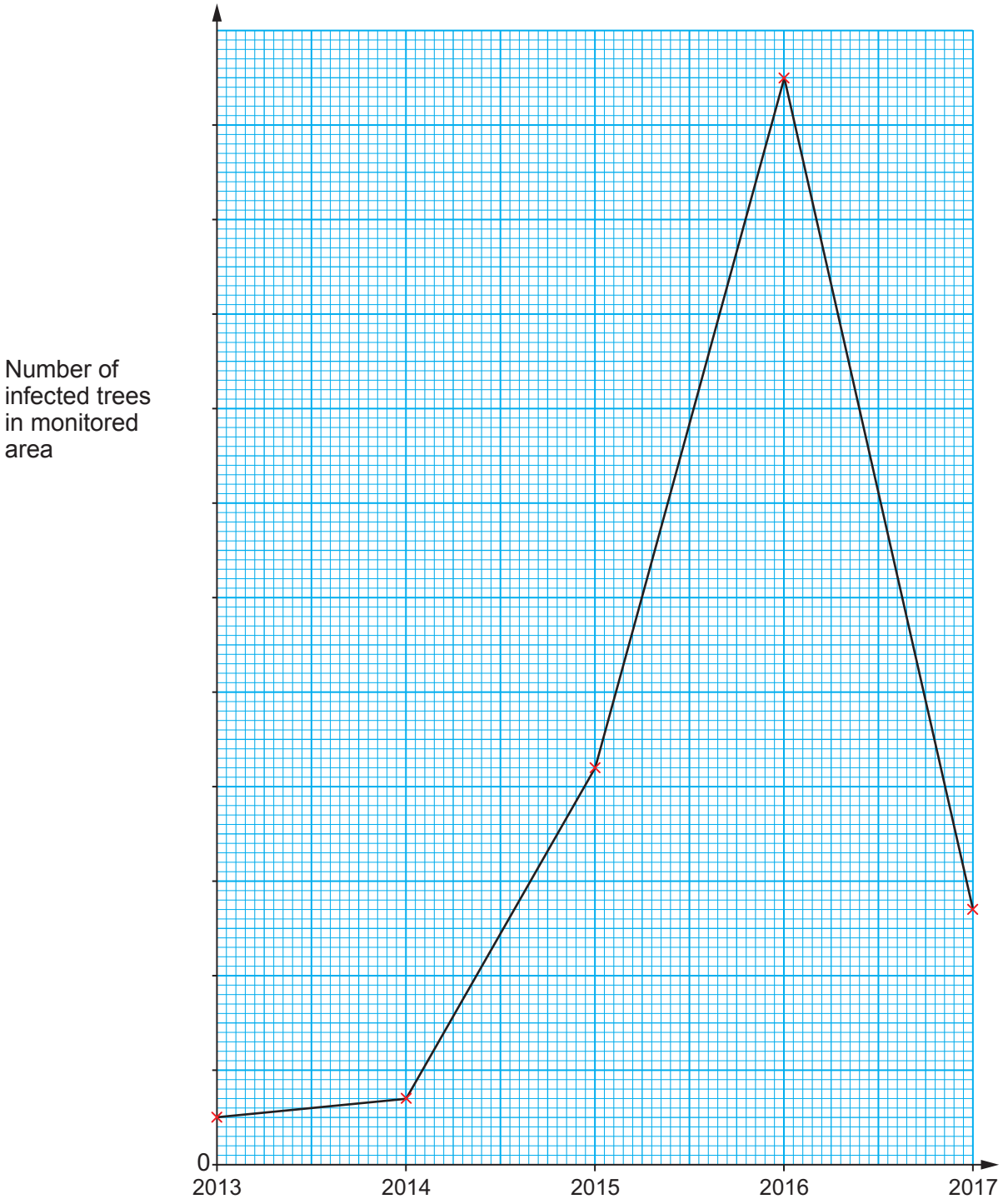
The results for Scotland have been plotted on the following graph.



(i) Complete the graph by

I. completing the scale for the number of infected trees in monitored area. [1]

II. plotting the data for Wales. [2]

III. drawing a line to join your plots. [1]

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(ii) From the graph, compare the trends in the data for Wales and Scotland giving **one** similarity and **one** difference. [2]

.....

.....

.....

.....

(iii) I. Calculate the mean annual **change** in number of infected trees in Wales for the **three** years from 2014 to 2017. **Give your answer to the nearest whole number.** [2]

Mean annual change = ... per year

II. **Using your answer to I**, estimate the number of infected trees for Wales for 2018. [1]

Number of infected trees = ...

(iv) In order to make their yearly monitoring a valid test, the scientists always observed areas of the same size. State **one** *other* way in which they could ensure valid testing. [1]

.....

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8. *(a)* State the meaning of the term *communicable disease* and give an example of one such disease in humans. [2]

.....

.....

The table below shows recommended guidelines from the NHS relating to lifestyle factors which affect health, together with data for two 30 year old male individuals, **A** and **B**.

		Individual	
Lifestyle factors	Recommended guidelines	***A***	***B***
Body Mass Index (BMI)	18.5 – 24.5	35	24
energy intake (kJ/day)	7500 – 8800	9500	7600
tobacco smoking (cigarettes per day)	0	0	25 – 40
alcohol (units per week)	< 14	27	0
exposure to UV light from the sun	low – moderate	low	moderate – high
aerobic exercise (minutes per week)	150+	40 – 50	800+

(b) Using the information above, describe how lifestyle factors could be affecting the risks of developing non-communicable diseases in individuals **A** and **B**. [6 QER]

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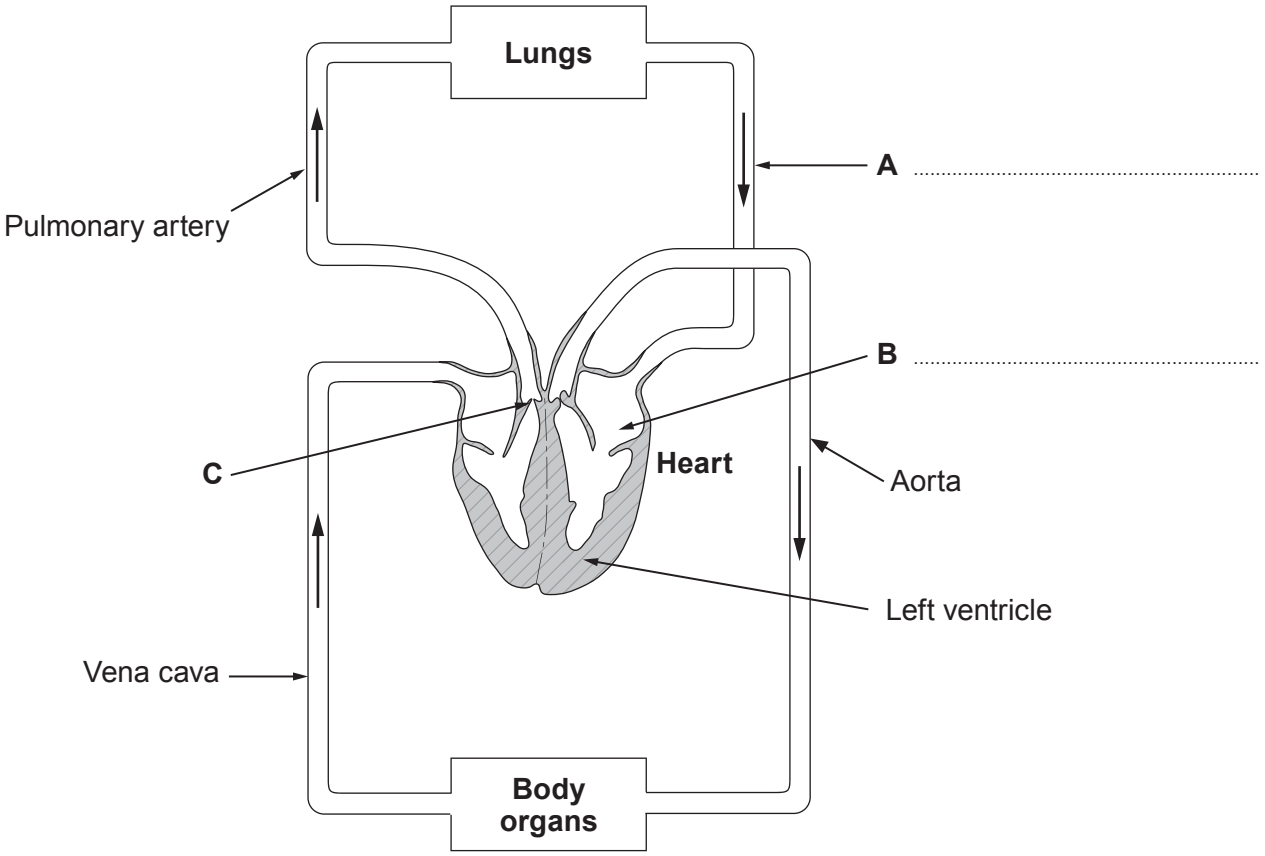
9. The diagram below shows the circulatory system of the human body.



(a) (i) On the diagram, label structures **A** and **B**. [1]

(ii) State the name of valve **C** and describe its function. [2]

.....

.....

Examiner only

(b) (i) Use the diagram to explain why the circulatory system of the human body is described as a *double circulation*. [1]

.....

.....

(ii) During an investigation, the blood pressures were measured in some of the blood vessels shown on the diagram. The results are given in the table.

	Pressure of blood (kPa)		
Blood vessels	Maximum	Minimum	Mean
Aorta	18.0	11.0	14.5
Pulmonary artery	12.0	8.0	10.0
Vena cava	1.0	0.2	.....

Use this information and the diagram to answer the following questions.

I. **Complete the table** by calculating the mean pressure for the vena cava. Write your answer in the table. [1]

II. State the cause of the difference in pressure shown in the table between the aorta and the pulmonary artery. [1]

.....

.....

III. From the table, describe the evidence that a double circulation system is necessary to maintain an effective supply of blood to the lungs. [2]

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Examiner only

(c) The table lists the percentages of blood supplied to parts of the body.

Organ	Percentage of blood supplied
Brain	16
Bone	4
Kidneys	25
Liver	10
Skin	5
All other organs of the body	40

Using the information in the table above, calculate the volume of blood supplied to **the liver** in **five minutes** when

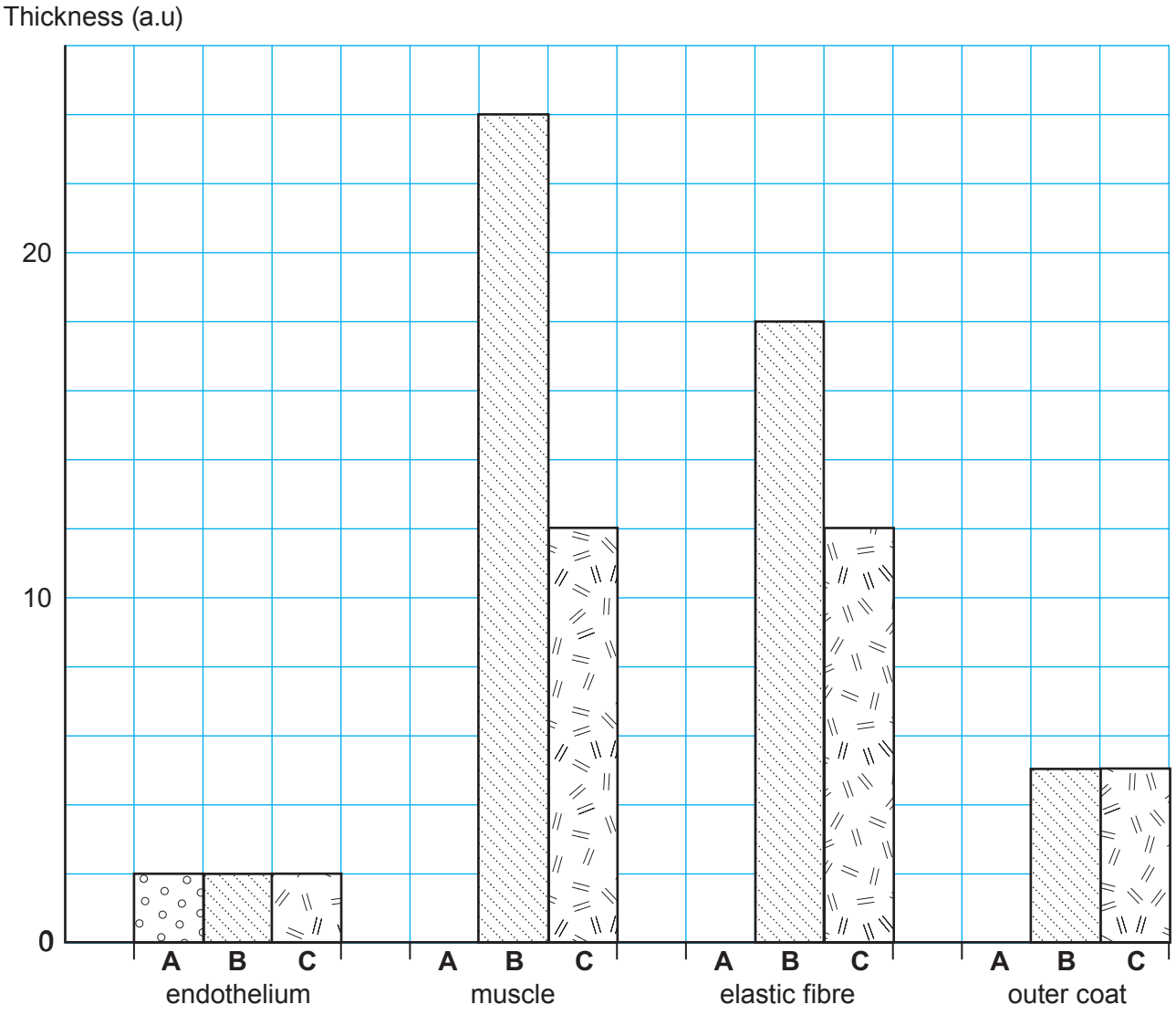
- volume of blood leaving the heart at each beat = 70 cm^3
- heart rate (number of beats per minute) = 72

Give your answer in **dm^3 to two decimal places**. [3]

Volume = ... dm^3

Examiner only

(d) The bar chart below compares the relative thickness of different tissues in the walls of three blood vessels **A**, **B** and **C** from the liver.



Identify which blood vessel **A**, **B** or **C** is a capillary. State the process which occurs when waste products from cells enter capillaries and describe how the capillary is well adapted for this process. [3]

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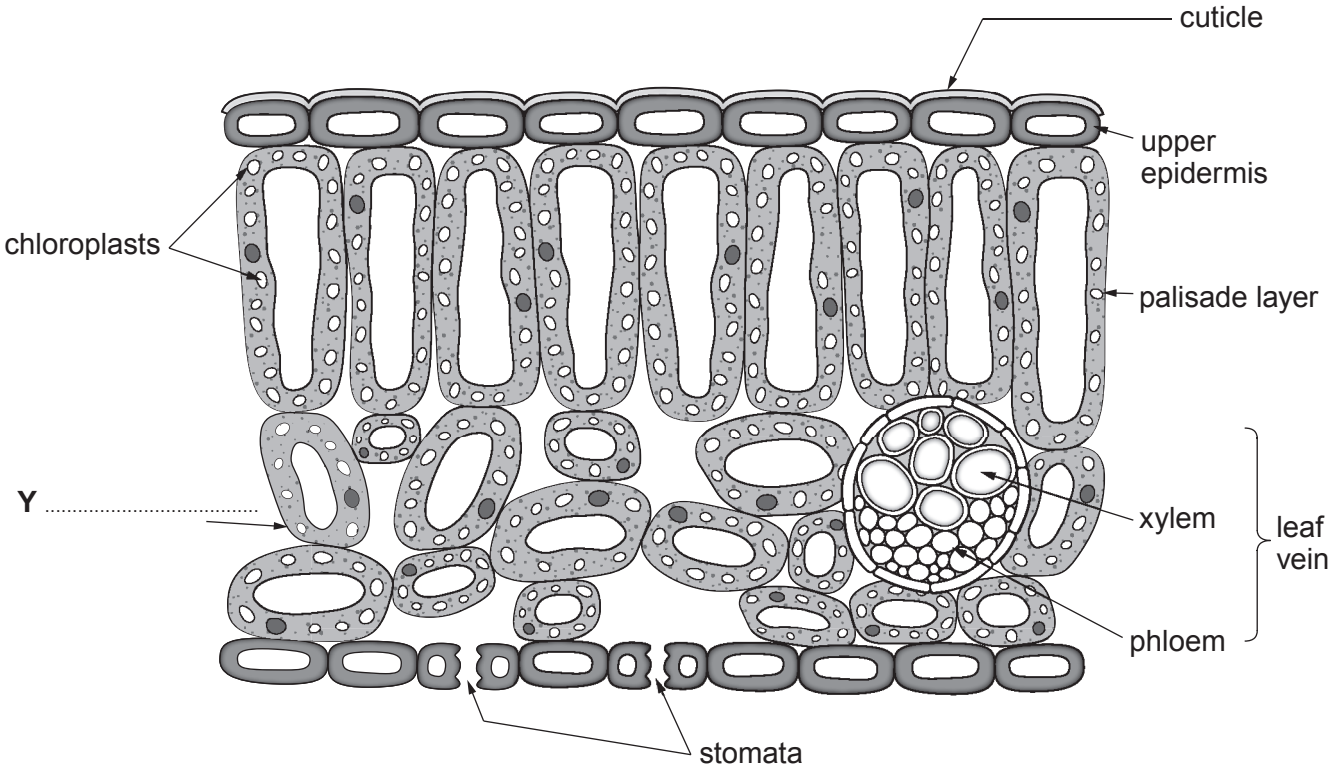
10. The diagram shows a section through the leaf of a plant.



(a) **On the diagram label** cell **Y**. [1]

(b) An Australian plant, the leafy Hakea *(Hakea sp)* produces two types of leaves. Plants produce one type of leaf in areas of bright sunlight, where the light intensity is high (type **P**) and another type in shaded areas where the light intensity is low (type **Q**).

leaf type **P**

Bright sunlight, high light intensity

leaf type **Q**

Shade, low light intensity

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The table below shows the results from an investigation of Hakea leaves.

Features	Leaf type **P** (bright sunlight, high light intensity)	Leaf type **Q** (shade, low light intensity)
Number of leaves per stem	5	15
Surface area of each leaf (mm^2)	150	292
Total leaf surface area per stem (mm^2)	750	.....
Mean number of chloroplasts in palisade cells	80	110
Cuticle thickness	24	14
Mean number of stomata in lower epidermis (per mm^2)	89	207

(i) Complete the table by calculating the total leaf surface area of a stem with type **Q** leaves. **Write your answer in the table.** [1]

Space for working.

(ii) From the table

I. Explain how type **P** leaves are better adapted to limit transpiration in bright sunlight than type **Q** leaves. [2]

.....

.....

.....

II. Explain how type **Q** leaves are better adapted for photosynthesis in shaded areas than type **P** leaves. [3]

.....

.....

.....

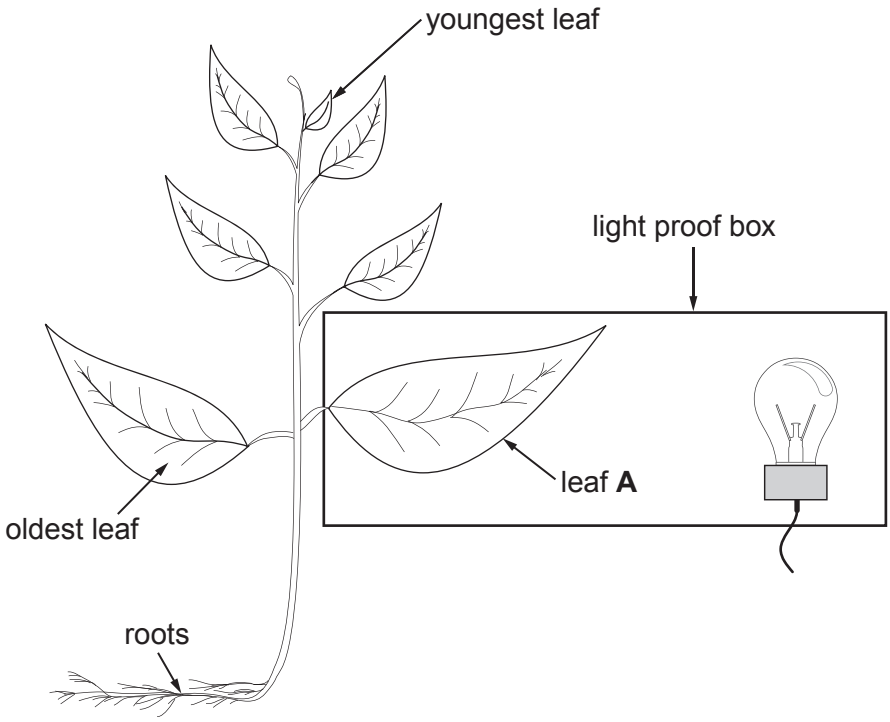
.....

(c) Phloem and xylem are found in the leaf vein. Phloem transports sugars. Give **one** way in which phloem is different from xylem. [1]

.....

(d) A scientist investigated the transport of sugars in one *Petunia* plant. The whole plant was kept in darkness for 24 hours before the investigation.

After 24 hours leaf **A** was exposed to light, as shown in the diagram, whilst the rest of the plant remained in darkness.



By using radioactive substances, the scientist was able to track the movement of the sugars made in leaf **A**, as they were transported to other parts of the plant. She noted the presence or absence of sugars in different parts of the plant over one hour.

The results of the investigation are shown in the table below.

	Time after start of investigation (min)						
	5	*10*	*20*	*30*	*40*	*50*	*60*
leaf **A**	✓	✓	✓	✓	✓	✓	✓
oldest leaf	**x**	**x**	✓	✓	✓	✓	✓
youngest leaf	**x**	✓	✓	✓	✓	✓	✓
root	**x**	**x**	**x**	**x**	**x**	✓	✓

Key ✓ = sugar present **x** = sugar absent

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(i) The scientist's hypothesis stated that

I. Sugar would be transported both upwards and downwards in the phloem of a plant.

II. It would be transported at different speeds.

From the table, evaluate the extent to which the results support the hypothesis. [3]

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.....

(ii) I. State how the scientist could check the repeatability of her results. [1]

.....

.....

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

.....

.....

(iii) I. At the end of the experiment the scientist found that sugars had been converted to starch in the root.

Describe how a test for starch would be carried out, stating the name of the chemical solution used and the colour change seen in a positive result. [2]

.....

.....

.....

II. State why it was necessary to place the plant in darkness for 24 hours before using it in this investigation. [1]

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.....

END OF PAPER