Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3400UA0-1

S17-3400UA0-1

BIOLOGY – Unit 1:
Cells, Organ Systems and Ecosystems

HIGHER TIER

WEDNESDAY, 14 JUNE 2017 – MORNING

1 hour 45 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**8**	
2.	**12**	
3.	**5**	
4.	**6**	
5.	**8**	
6.	**12**	
7.	**7**	
8.	**10**	
9.	**6**	
10.	**6**	
Total	**80**	

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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.
Question **9** is a quality of extended response (QER) question where your writing skills will be assessed.

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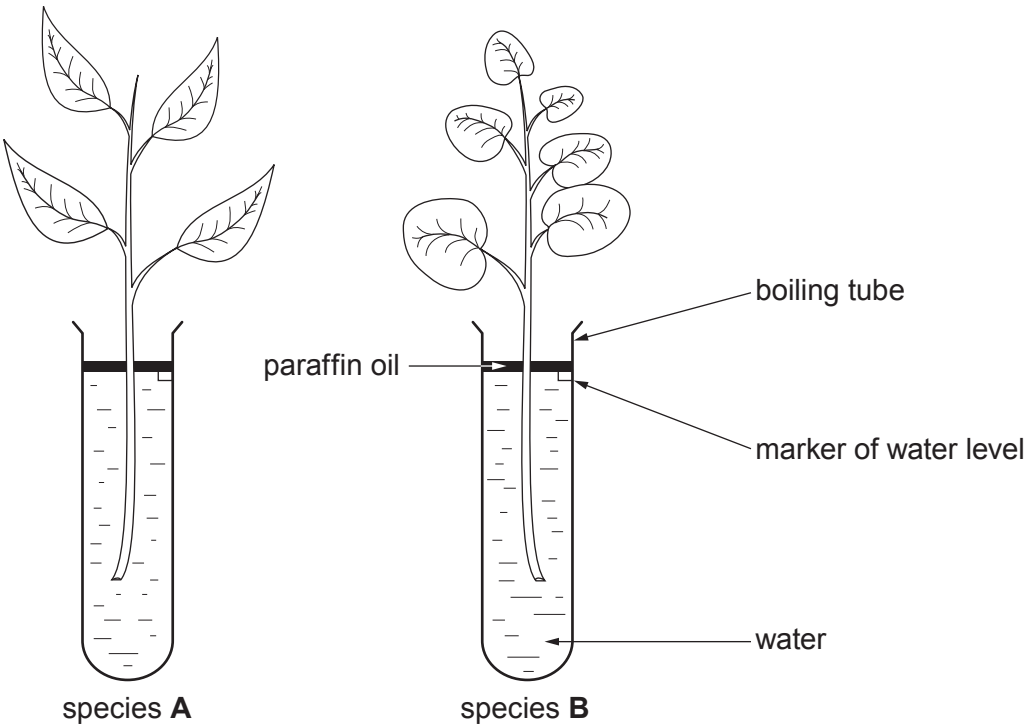
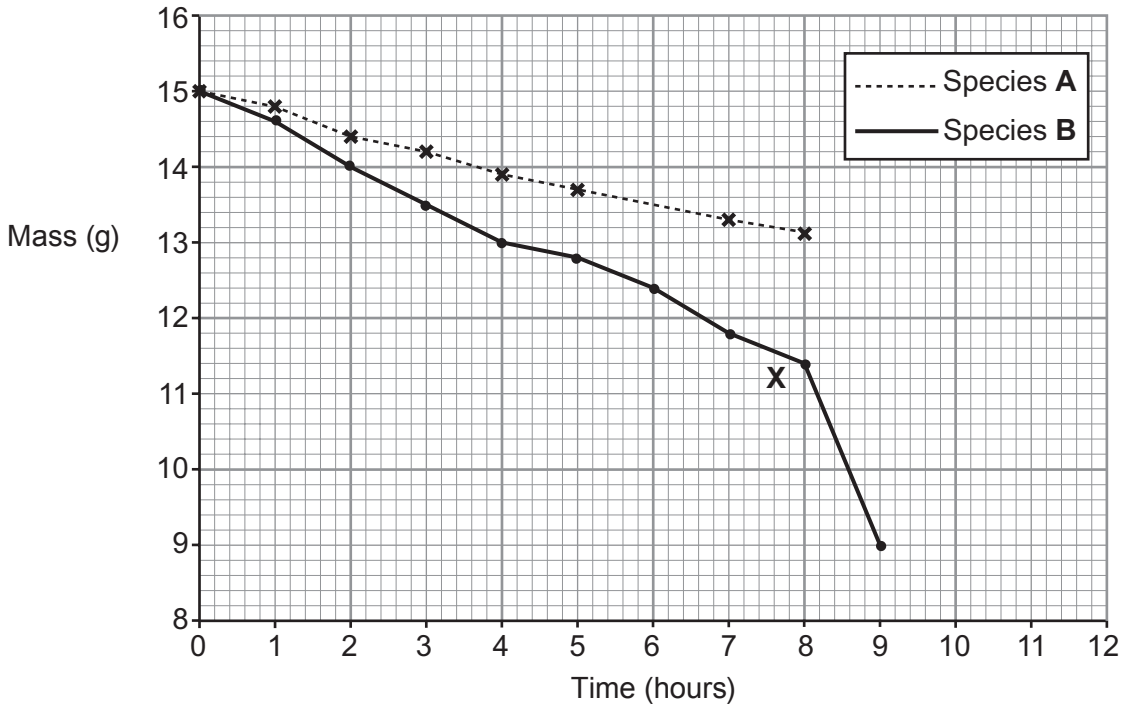
Answer **all** *questions.*

1. Shoots from two different species of plants, **A** and **B**, were placed in water in boiling tubes as shown below.



Both species were kept in the same conditions and their mass recorded at hourly intervals for eight hours. The results were recorded as line graphs shown below.



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(a) (i) Use the data to help you calculate the difference in the loss in mass between species **A** and **B** at 8 hours. [1]

Difference in loss of mass = ... g

(ii) State the term given to the process responsible for this loss of mass in plants. [1]

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(iii) Suggest **two** reasons for the difference in loss of mass between the two different species, **A** and **B**. [2]

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(iv) State the purpose of the paraffin oil in the boiling tubes. [1]

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(b) Which **one** of the following treatments was applied to species **B**, at point **X** on the graph, to produce the result shown at 9 hours?

Underline the correct answer. [1]

Enclosed in a bell jar

Upper surface of leaves coated with Vaseline

Half the leaves removed

Air directed at the leaves by a fan

(c) What would you expect to happen to the rate of loss of mass if species **A** and **B** had roots? Give a reason for your answer. [2]

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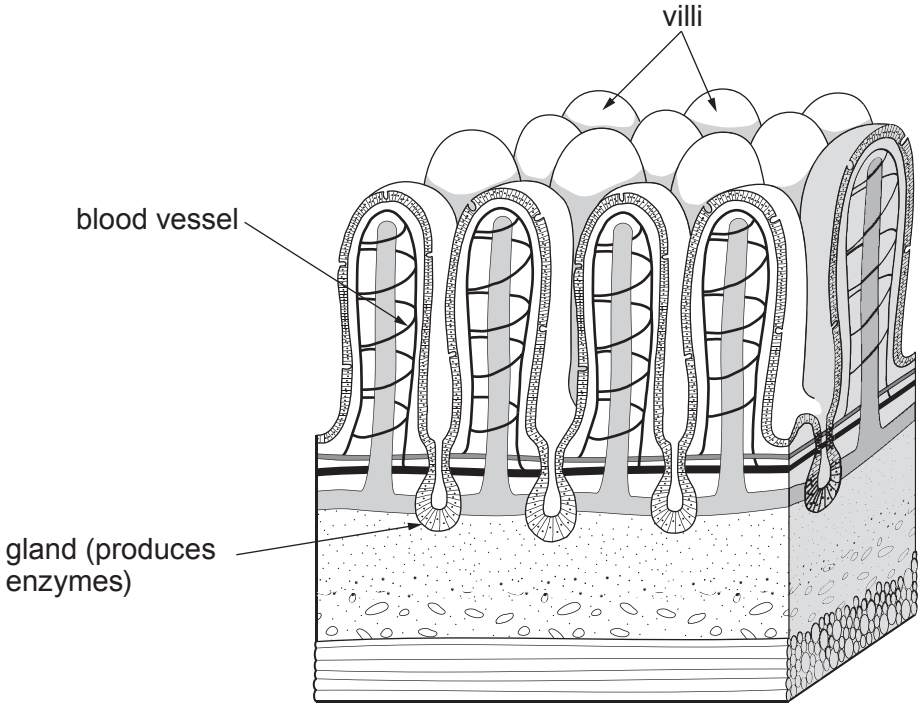
2. The drawing shows the lining of part of the digestive system.



(a) Name the part of the digestive system that has this lining. [1]

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(b) If the surface area of a single villus is 5 mm^2, calculate the total surface area of all the villi shown. Assume that all the villi are complete and include a unit in your answer. [1]

Total surface area = ...

unit = ...

(c) State **two** functions carried out in this part of the digestive system. [2]

Function 1. .....

Function 2. .....

Examiner only

(d) State **one** feature of the digestive system which helps this part carry out each function named in *(c)*. [2]

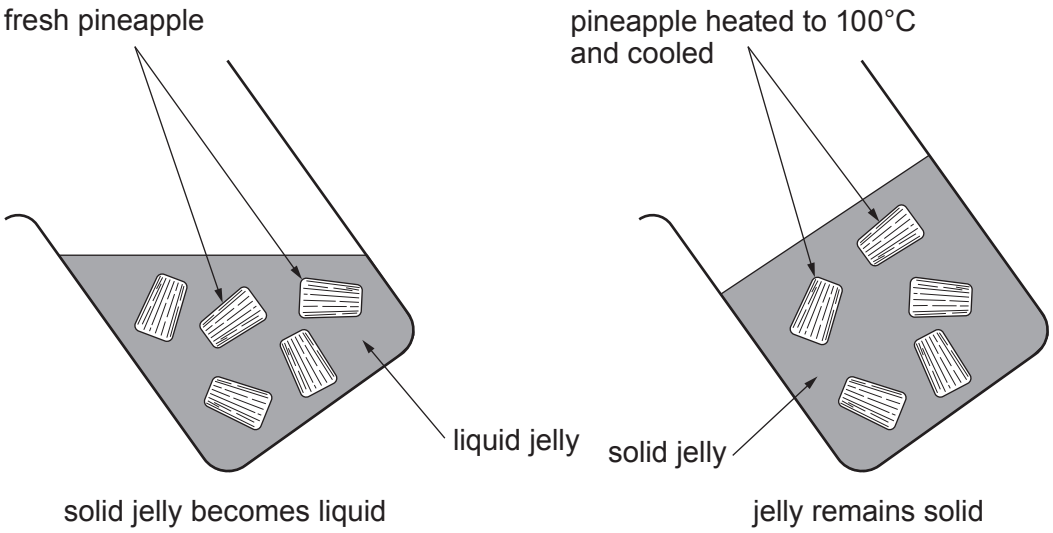
Function 1. .....

Function 2. .....

(e) Fresh pineapple is sometimes added to meat to make it tender. Fresh pineapple contains a protease enzyme.
Alan investigated how this took place. He used the following:

- fresh pineapple
- pineapple that had been heated to 100 °C and cooled
- a solid jelly made from protein called gelatin

Two samples of solid jelly were made and the pineapple was pushed into them. After 24 hours the results were shown below:



Explain the results with:

(i) fresh pineapple; [3]

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(ii) pineapple heated to 100 °C and cooled. [3]

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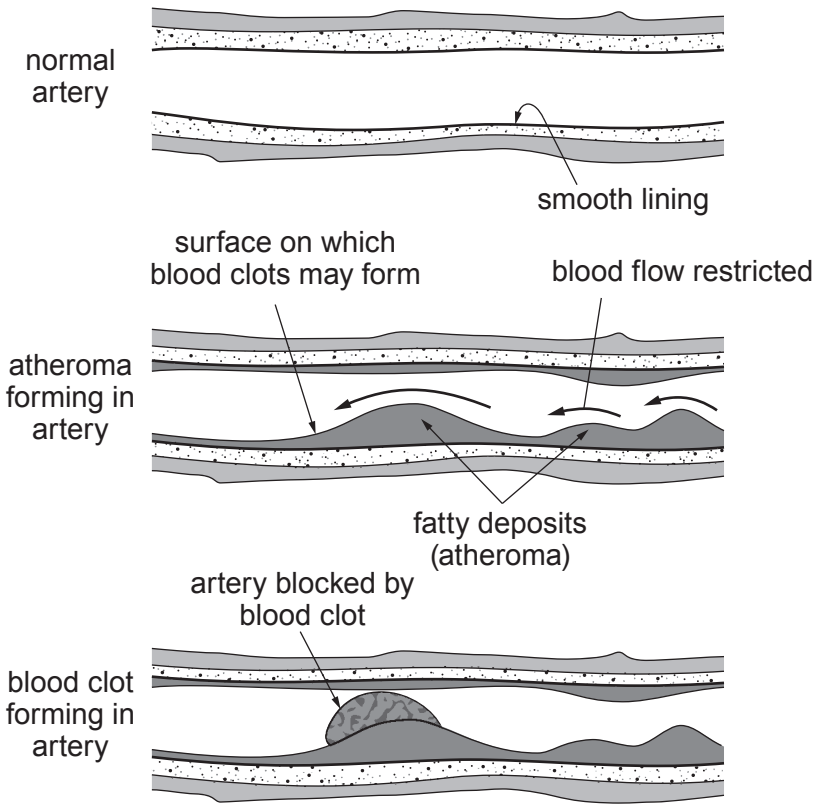
3. The diagrams show fatty deposits (an atheroma) building up in an artery. One cause of this is high cholesterol. This may eventually cause a blood clot to form.



(a) Explain how an unbalanced diet and lack of exercise could lead to an atheroma formation. [2]

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(b) Name a group of drugs which reduces the chance of build-up of fatty deposits in arteries. [1]

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(c) Explain how an atheroma may lead to a heart attack. [2]

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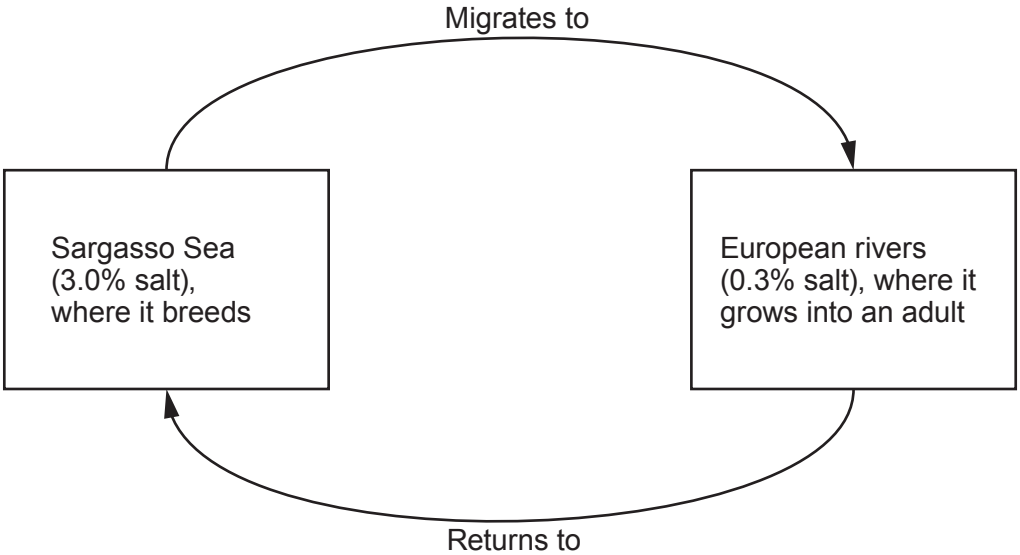
4. The common eel *(Anguilla anguilla)*, spends some of its life in fresh water and some of its life in sea water. It breeds in the Sargasso Sea near Central America and migrates to European rivers where it becomes an adult. After several years, it becomes sexually mature and returns to the Sargasso Sea to breed.

Life cycle of the common eel



(a) Explain why osmosis could be a problem to the eels when they return from fresh water (0.3% salt) to sea water (3.0% salt). [3]

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(b) Eels are able to absorb salt against a concentration gradient.

Name the process responsible for this and the **two** chemicals that are needed for the process. [3]

Name of process .....

Chemicals 1 .....

2 .....

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5. *(a)* The table shows a comparison for two athletes, Tomos and Jeremy, who ran in races of different distances.

Athlete	Distance of race (m)	Oxygen needed in the race (dm^3)	Oxygen entering blood in the race (dm^3)
Tomos	100	10	0.5
Jeremy	10 000	150	134.0

(i) The difference between the oxygen needed and the oxygen actually entering the blood during the race is the oxygen debt.
Calculate the oxygen debt for [1]

Tomos ..... dm^3

Jeremy ..... dm^3

(ii) When the race was over, both athletes continued to breathe more rapidly and more deeply than normal for some time. Give the reason for this. [1]

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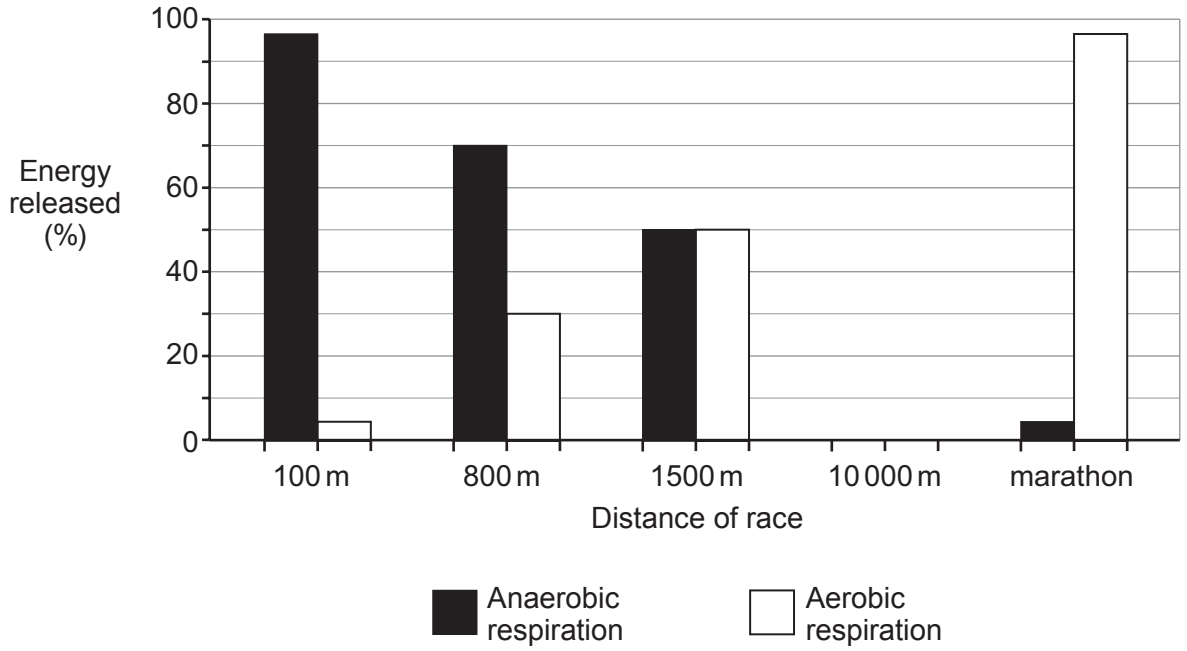
(b) The bar chart shows the percentage of energy released by aerobic and anaerobic respiration for athletes running different distances.



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(i) What can be concluded from the data shown in the table and the bar chart for the athlete running 100 m? [1]

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(ii) **On the bar chart opposite, draw bars** that you would expect for an athlete running in a 10 000 m race. [2]

(c) Write the word equations to represent:

(i) Aerobic respiration in human muscle tissue; [1]

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(ii) Anaerobic respiration in human muscle tissue. [1]

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(d) Why is aerobic respiration more efficient than anaerobic respiration? [1]

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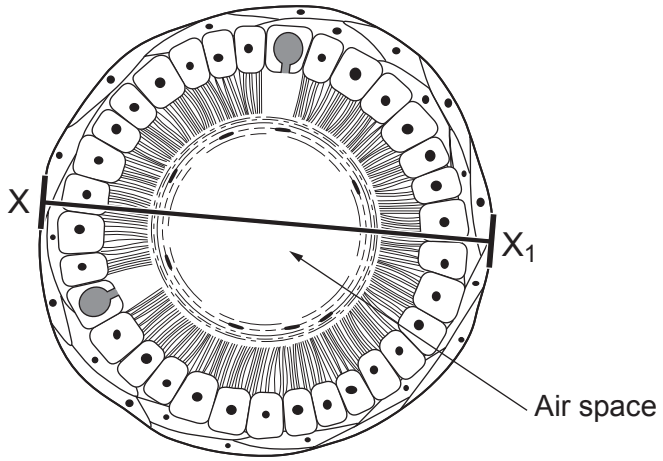
6. The diagram below shows a cross section of a healthy bronchiole.

Diagram **A**

A healthy bronchiole



(a) If the magnification of diagram **A** is x 50, use the line **X–X_1** to calculate the actual diameter of the bronchiole. [1]

Diameter = ... mm

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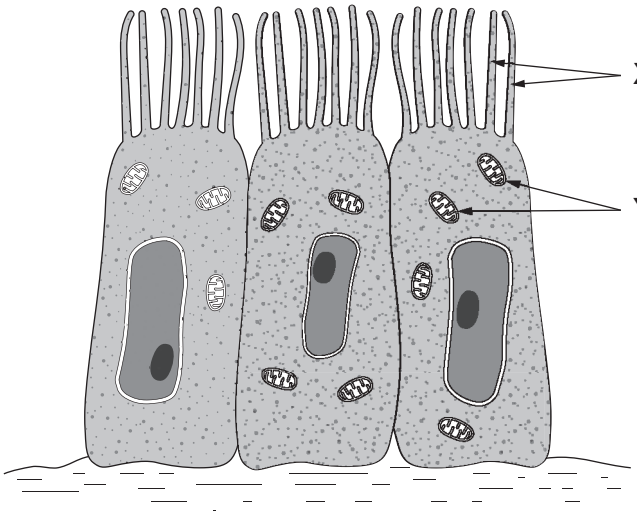
(b) (i) Diagram **B** below shows a highly magnified close-up of three cells of the lining of the bronchiole.
Label parts **X** and **Y** on diagram **B**. [2]

Diagram **B**



(ii) Explain how the process taking place in part **Y** allows part **X** to carry out its function. [3]

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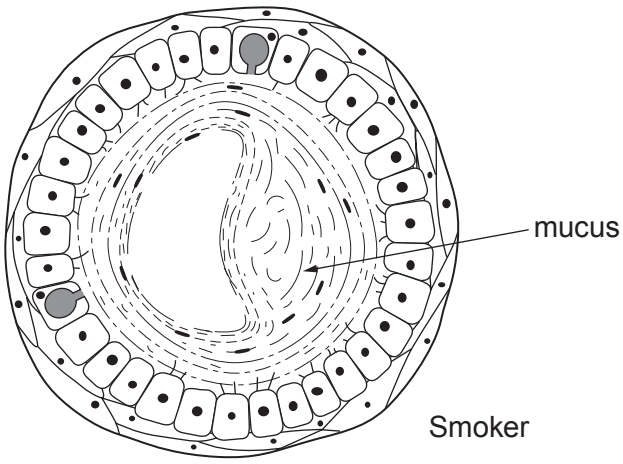
The following diagram shows a section through a bronchiole from a person who had smoked for 20 years.



(c) What would you expect to find in the mucus of this person? [1]

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(d) Nicotine is the addictive substance in tobacco. People can be helped to stop the habit of smoking by giving them nicotine replacement therapy (NRT). The table gives the results of the trials of different types of NRT. The placebo is a neutral substance which does not contain nicotine.

	Smokers given NRT		Smokers given a placebo	
Type of NRT	Numbers of smokers in trial	Percentage of smokers who gave up smoking	Numbers of smokers in trial	Percentage of smokers who gave up smoking
chewing gum	7708	20	9319	12
patch on skin	7387	14	5969	8
nasal spray	448	24	439	12
inhaler	490	14	486	8
tablet	243	20	245	13

(i) Why was the placebo used in these trials? [1]

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(ii) Use the results to state the type of NRT in which scientists would have the greatest confidence. Give a reason for your answer. [2]

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(iii) Which type of NRT was most effective? Give a reason for your answer. [2]

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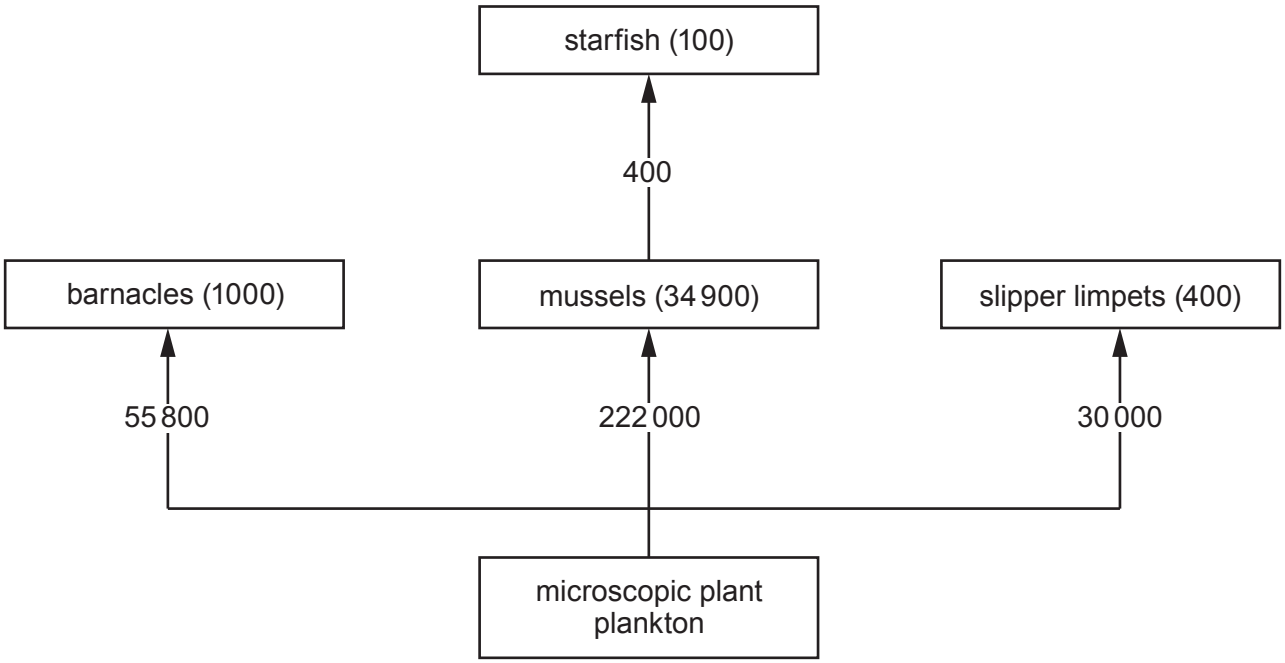
7. The flow diagram shows the transfer of energy between organisms on a rocky shore. Numbers on the arrows show the energy available to the organisms in kJ per m^2 per year. Numbers in brackets show the energy that becomes part of the biomass of the organisms in kJ per m^2 per year.



The energy efficiency of an organism is a measure of how much of the energy available to the organism becomes part of its biomass. It is calculated by using the following equation:

$$\% \text{ energy efficiency} = \frac{\text{energy that becomes part of biomass}}{\text{energy available}} \times 100$$

(a) (i) Calculate the energy efficiency of the starfish. [2]

energy efficiency = ... %

(ii) Calculate the percentage of the energy entering the mussels that enters the starfish to **three** significant figures. Show your working. [3]

percentage of the energy entering the mussels = ... %

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(b) The diagrams show pyramids of numbers for four ecosystems.

A **B** **C** **D**

Which **one** of the pyramids of numbers represents the flow diagram of this rocky sea shore? State a reason for your answer. [2]

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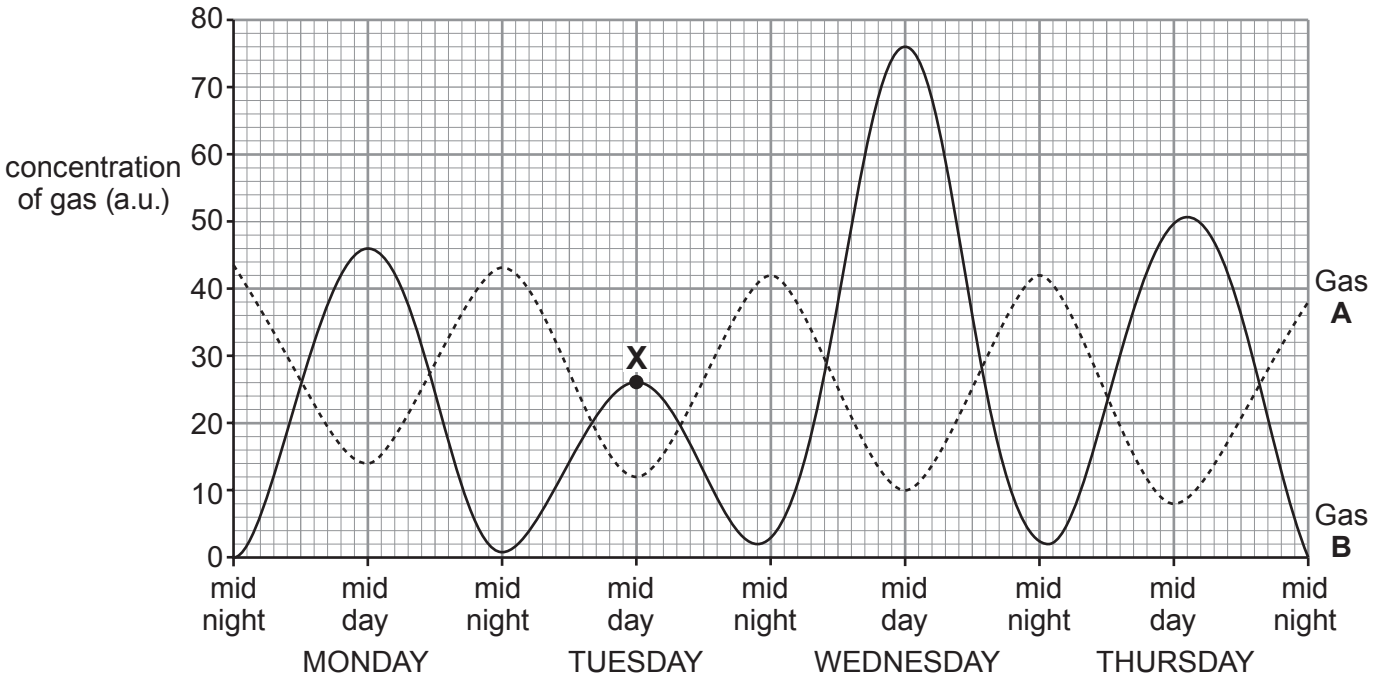
8. The graphs below show changes in the concentration of two gases, **A** and **B**, in a rock pool in St Brides Bay, Pembrokeshire over a 4-day period. The rock pool has a high biomass of plants.



(a) (i) Identify gases **A** and **B**. [2]

Gas **A** .....

Gas **B** .....

(ii) Explain the results at midday for gas: [4]

A; .....

.....

.....

B. .....

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(iii) Suggest a reason for the lowest peak at point **X**. [1]

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(iv) Calculate the mean maximum concentration of gas **B** over 4 days. [2]

mean maximum concentration of gas **B** = ... a.u.

(b) Name the limiting factor that can be deduced from the data in the graph. [1]

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9. Urea is an animal waste substance which contains nitrogen. Explain how nitrogen in the urea from cattle in a field of grass is recycled to become protein in beef. [6 QER]

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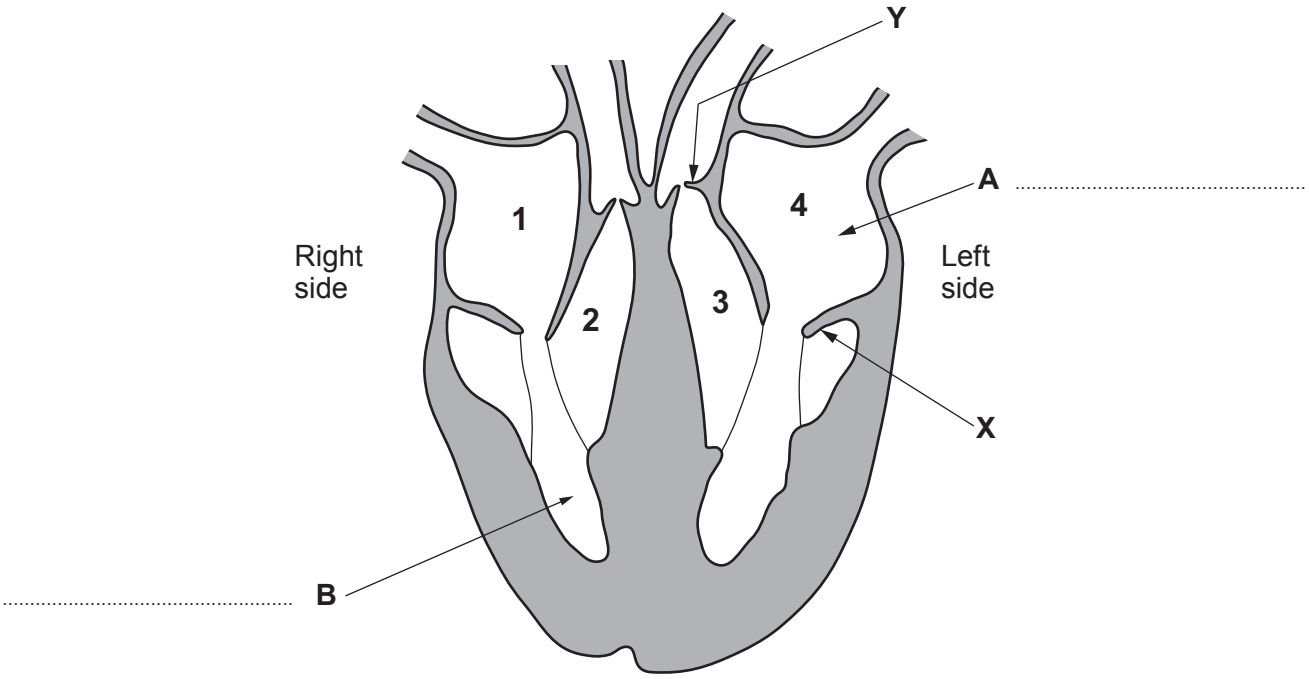
10. The diagram shows a section through the heart.



(a) (i) Label parts **A** and **B on the diagram**. [2]

(ii) Draw arrows at points **1**, **2**, **3** and **4** on the diagram to show the direction of flow of blood. [2]

(b) The table shows the pressure readings in parts of the heart while it is pumping blood.

	Pressure when left ventricle is contracting (kPa)	Pressure when left ventricle is relaxing (kPa)
left ventricle	16.0	0.7
left atrium	0.4	1.1
aorta	12.0	10.7

(i) Use the data in the table to state the pressure in the following parts when the valve labelled **X** is open. [1]

Part	Pressure (kPa)
left ventricle	.....
left atrium	.....

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(ii) Use the data in the table to state the pressure in the following parts when the valve labelled **Y** is open. [1]

Part	Pressure (kPa)
left ventricle	.....
left atrium	.....

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END OF PAPER