Surname	Centre Number	Candidate Number
First name(s)		0

GCSE

3430UA0-1

S23-3430UA0-1

TUESDAY, 13 JUNE 2023 – MORNING

SCIENCE (Double Award)
Unit 1: BIOLOGY 1
HIGHER TIER

1 hour 15 minutes

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

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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 or correction fluid.

You may use a pencil for graphs and diagrams only.

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 page 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.

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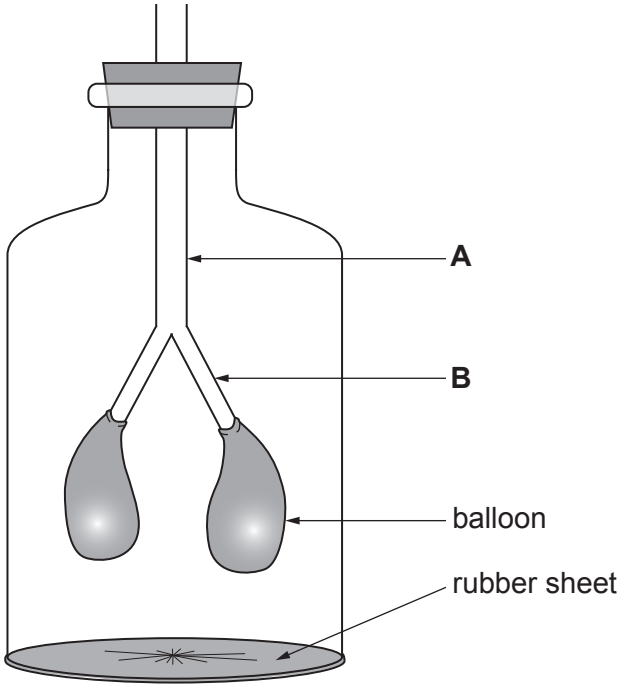
Answer **all** questions.

1. **Image 1** shows the bell jar model which is being used to demonstrate inspiration.

Image 1



(a) (i) Parts **A** and **B** in **Image 1** represent two parts of the human respiratory system.

Complete the following sentence: [2]

In the bell jar model, part **A** represents the ..... and part **B** represents the ..... .

(ii) As the rubber sheet is pulled down, the air pressure inside the bell jar changes. Explain how the air pressure change in the bell jar causes the balloons to inflate. [2]

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(b) The balloons are in an air-tight space in the bell jar. Lungs are sealed in an air-tight space in the chest.

A wound to the chest means the chest is no longer air-tight. As a result, the wounded person cannot fully inflate their lungs.

Explain why a person with a hole in the chest cannot fully inflate their lungs. [1]

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2. **Image 2.1** and **Image 2.2** show examples of two methods of farming hens for egg production.

Image 2.1 – Intensively farmed chickens

Image 2.2 – Free-range chickens

- Intensive farming methods maximise production by controlling the conditions in which farm animals are kept. Inside animal sheds, temperatures may be kept high and each animal is given limited space.
- In 2015, a survey of 2000 people (*OnePoll*) found that 80% of those questioned always or often bought free-range eggs, even though they were more expensive.

Table 2.3 shows egg production in the UK by intensive and free-range methods between 2006 and 2016.

Table 2.3

Year	Egg production (billion)	
	intensive	free-range
2006	4.1	1.9
2008	4.0	2.1
2010	3.8	2.8
2012	3.5	3.4
2014	3.9	3.3
2016	3.8	3.8

(a) Use **Table 2.3** and the information above to answer the following questions.

(i) Calculate the percentage increase in the production of **free-range eggs** between 2006 and 2016. [2]

Increase = ... %

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(ii) Give **one** way that intensive farming methods minimise energy loss from farm animals. Explain your answer. [2]

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(b) Suggest **two** reasons why many people buy free-range eggs, even though they are more expensive than eggs produced by intensive farming methods. [2]

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(c) (i) State **one** possible **pollutant** from intensive farming methods and explain how it could damage the environment. [2]

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(ii) Farmers in Wales who plan to develop intensive methods of food production on rural land must first submit their plans to biologists at Natural Resources Wales. Describe the role of the biologists at both the planning stage and when the intensive farm is operating fully. [2]

Planning stage

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When operating fully

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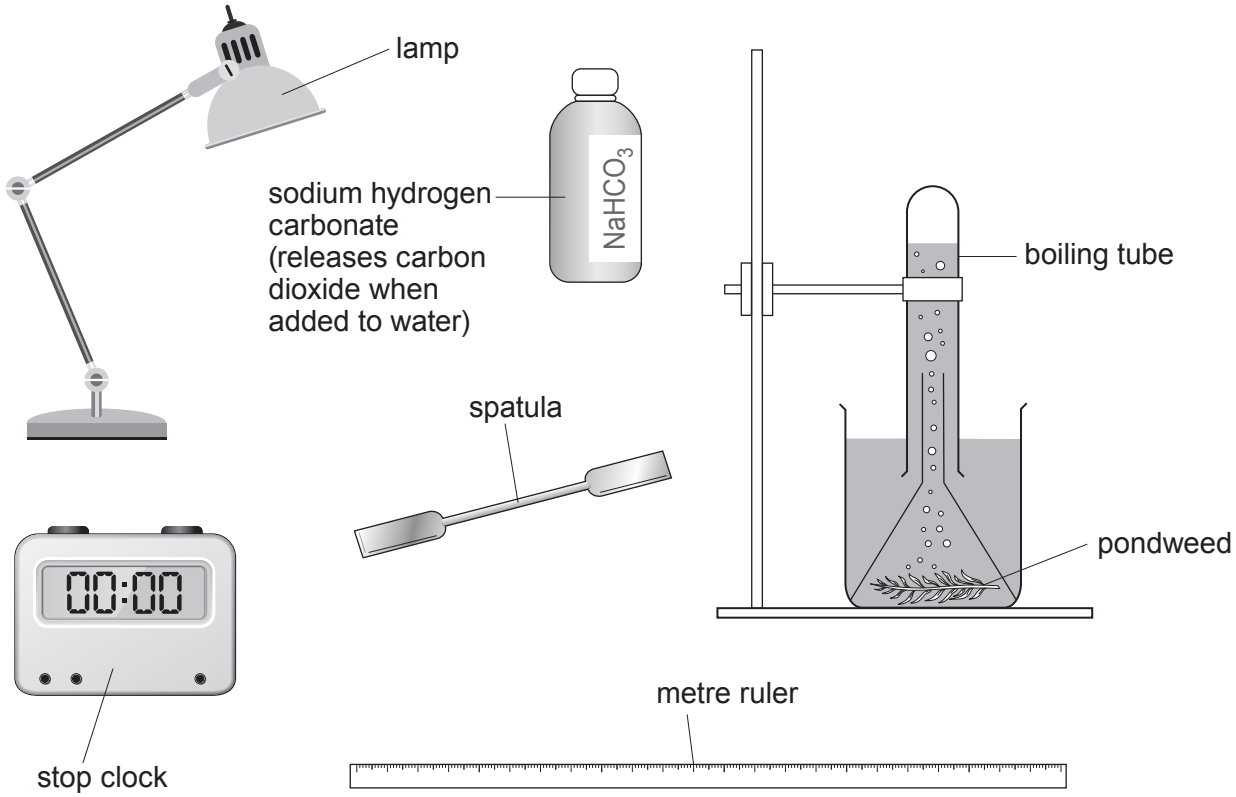
3. (a) Describe how you would investigate the effect of light intensity on the rate of photosynthesis using **only** the apparatus shown in **Image 3**. [6 QER]

Image 3



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(b) It is possible to determine if photosynthesis is taking place by testing a leaf for the presence of starch using iodine solution. Explain why this test is not suitable for determining the **rate** of photosynthesis. [1]

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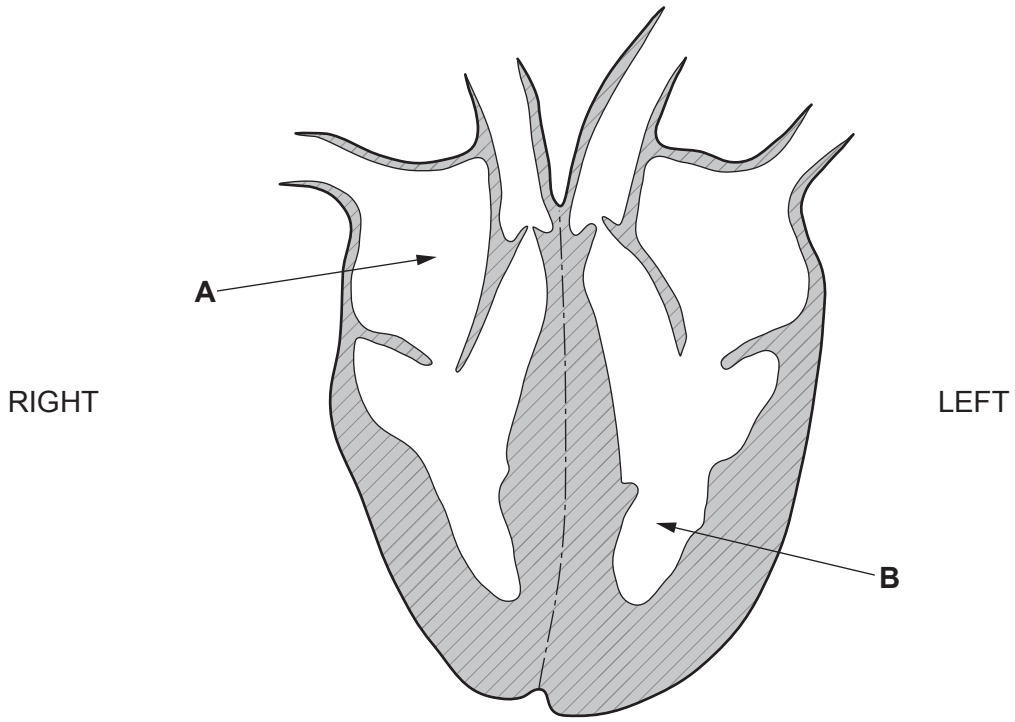
4. **Image 4.1** shows a section through a human heart.

Image 4.1



(a) (i) State the name of chambers **A** and **B** shown in **Image 4.1**. [1]

A .....

B .....

(ii) Humans rely on a double circulatory system. State what is meant by a double circulatory system. [2]

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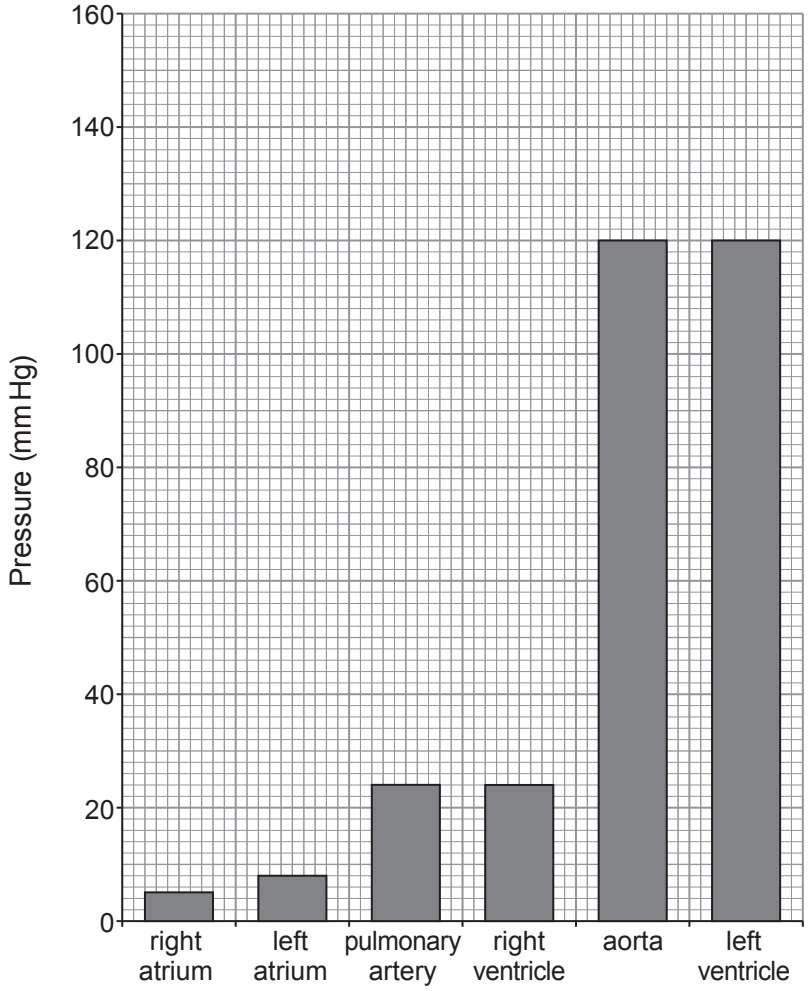
(b) **Graph 4.2** shows the maximum pressure that occurs in the heart and associated blood vessels during the cardiac cycle.

Graph 4.2



(i) I. Calculate the difference in the maximum pressure between the right ventricle and the left ventricle. [1]

Difference in pressure = ... mm Hg

II. State how the structure of the left ventricle causes this difference in pressure. [1]

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(ii) Suggest why the maximum pressure in the aorta is the same as that in the left ventricle. [1]

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(c) Cardiovascular disease (CVD) is a general term for conditions affecting the heart or blood vessels. High blood pressure is one of the most important risk factors for CVD. Scientists carried out an investigation to test the following hypothesis:

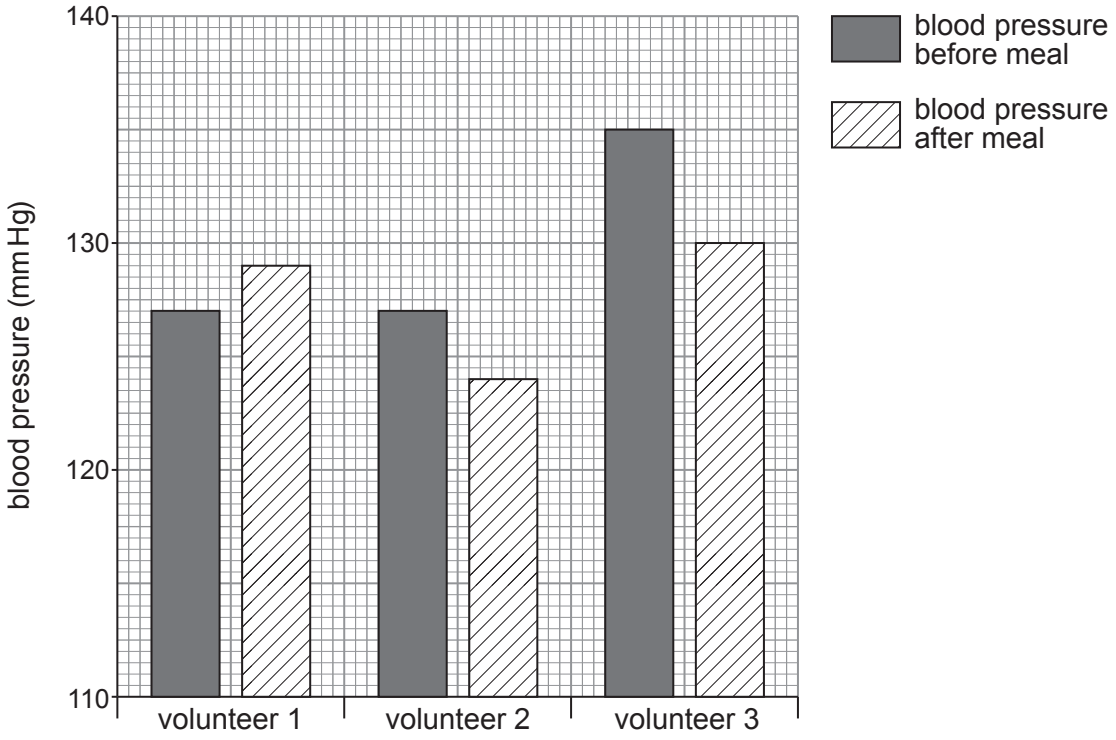
'Eating food or drink that is high in nitrate causes blood vessels to widen, leading to a decrease in blood pressure.'

The investigation was carried out as follows:

- Three volunteers were each given a different meal.
- Volunteer **1**: A salad made from vegetables that naturally contain almost no nitrate.
- Volunteer **2**: A salad containing spinach and rocket, which have naturally high levels of nitrate.
- Volunteer **3**: A portion of beetroot juice, calculated to contain exactly the same quantity of nitrate as the meal eaten by volunteer **2**.
- The blood pressure of each volunteer was tested before and after their meal.

The results are shown in **Graph 4.3**.

Graph 4.3



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State **two** conclusions which can be made from these results. [2]

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(d) Suggest why the widening of coronary arteries can lower the risk of a heart attack. [2]

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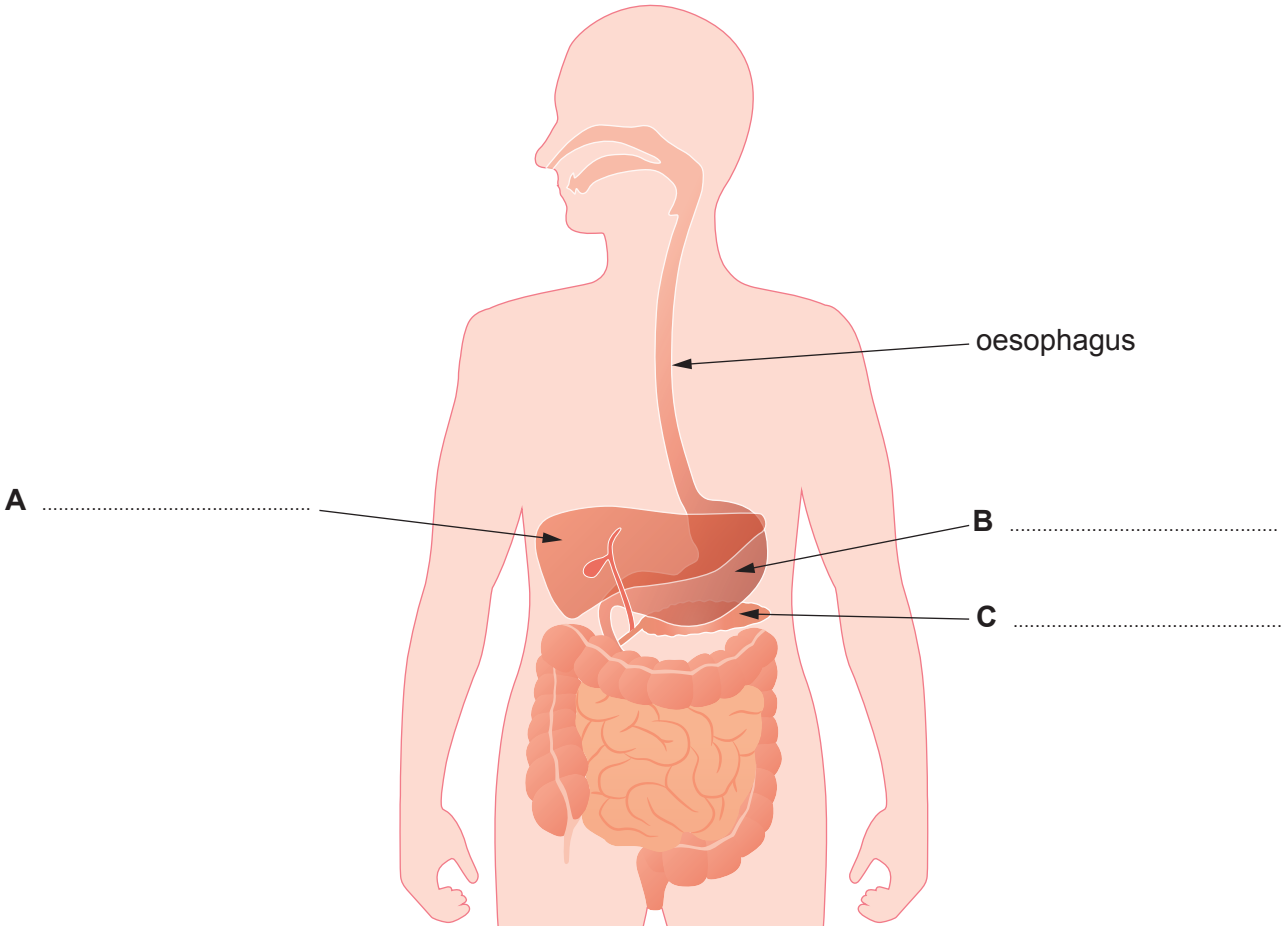
5. **Image 5.1** shows part of the digestive system.

Image 5.1



(a) **Label parts A** to **C** on **Image 5.1**. [2]

(b) Explain why carbohydrase cannot digest fat. [1]

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(c) Scientists investigated absorption of three different sugars in a sample of healthy small intestine in the laboratory. They analysed the absorption of the sugars in the presence or absence of cyanide. Cyanide is a chemical that prevents respiration taking place in cells.

The results are shown in **Table 5.2**.

Table 5.2

Sugar	Absorption without cyanide (a.u.)	Absorption with cyanide (a.u.)
glucose	100	33
xylose	30	30
arabinose	29	29

Use the information in **Table 5.2** to answer the following questions.

(i) State which sugar is absorbed by active transport. Explain your answer. [4]

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(ii) One of the scientists stated that all three of the sugars in the investigation could be absorbed by diffusion. Explain how the evidence in **Table 5.2** supports this conclusion. [2]

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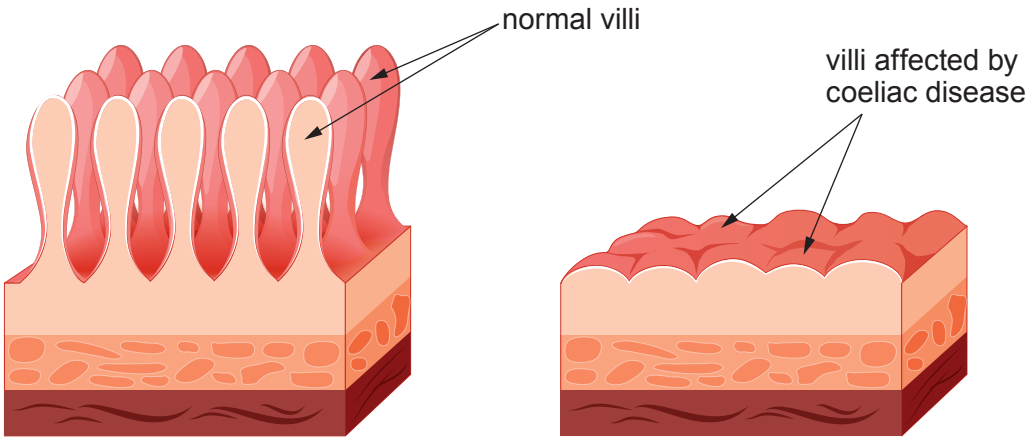
(d) **Image 5.3** shows the structure of the lining of the small intestine of a healthy individual and an individual with coeliac disease. Coeliac disease causes a flattening of the villi lining the small intestine.

Image 5.3



Use **Image 5.3** to explain why individuals who have coeliac disease are unable to fully absorb their digested food. [1]

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6. **Image 6** appeared on the BBC news website in 2018.

Image 6

Florida powerless to stop killer algal bloom.

In Florida, the uncontrolled growth of toxic algae known as “red tide” has caused an emergency. The sea waters are now a dark red colour. The red tide has left tonnes of dead animals, affected local businesses and worried the inhabitants. The abundance of the toxic algae has devastating effects all the way along food chains. More than 5 tonnes of dead fish have been reported, and the death of many dolphins. Shellfish such as clams, oysters and mussels are not affected but have been found to contain toxins produced by the algae.

Red tide

(a) Use the information in **Image 6** to answer the following questions.

(i) Red tide has been suspected of causing poisoning in humans. Whilst the poisonings have not been fatal many individuals have been admitted to hospital.

Suggest how humans were poisoned. [2]

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(ii) The recent red tide has killed approximately 500 turtles, as they ingest the algae when they feed on sea grasses. Prior to this, the population of turtles in Florida waters was estimated at 51 000. Calculate the percentage of turtles that have died as a result of red tide. **Give your answer to two significant figures.** [3]

Percentage of turtles killed = ... %

(b) Dead zones are areas of water with reduced oxygen levels. Some scientists have argued that the red tide can lead to dead zones forming in the sea. Explain how the increase in algal growth described in the article could lead to dead zones. [5]

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TURN OVER FOR QUESTION 7

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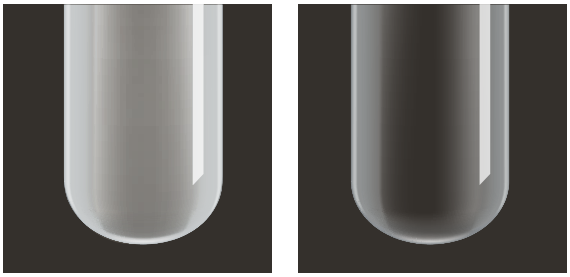
7. Dried milk powder and whey powder both contain protein. A weight lifter wanted to determine which would be more beneficial in his diet for his performance.

In order to do this, he first prepared equal volumes of known concentrations of protein for comparison. He then added 5 cm^3 of 5% enzyme solution to each and recorded the time taken for the protein-enzyme mixture to go from cloudy to clear. **This colour change is shown in Image 7.1.**

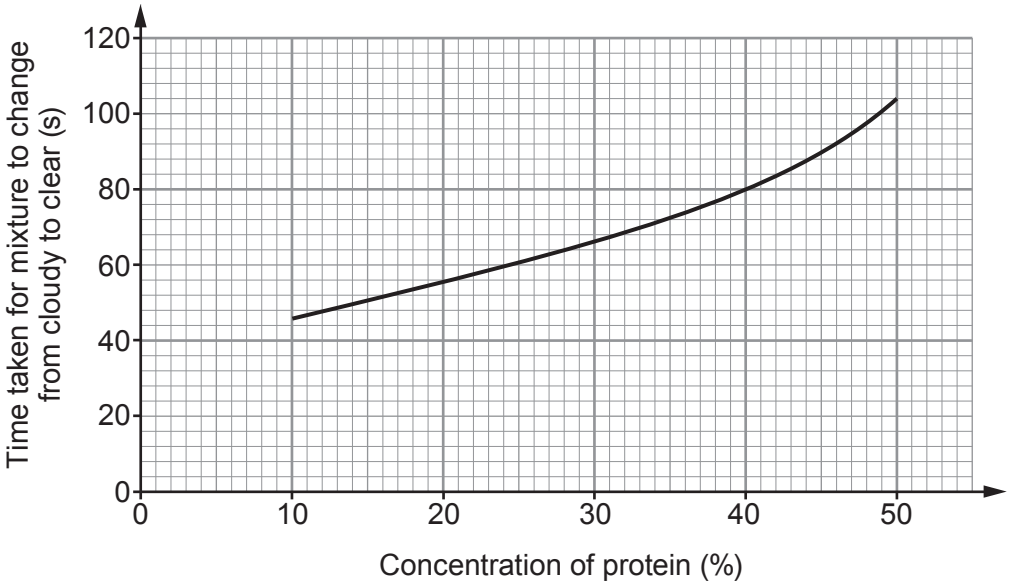
Image 7.1



Before enzyme added | After enzyme added

His results are shown in the **Graph 7.2**.

Graph 7.2



(a) (i) State the independent and dependent variables. [2]

Independent variable .....

Dependent variable .....

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(ii) Name the type of enzyme which was added to the protein **and** explain the change in appearance from cloudy to clear. [2]

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(iii) State **one** source of uncertainty in the experimental method **and** suggest how it could be overcome. [2]

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(b) The weight lifter then carried out the experiment using a sample of dried milk powder followed by a sample of whey powder. The milk powder took 72 seconds to clear and the whey powder took 100 seconds to clear.

Use data from **Graph 7.2** to explain why the weight lifter concluded he should use whey powder rather than dried milk powder in his diet to improve his performance. [2]

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END OF PAPER

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Question number	Additional page, if required. Write the question number(s) in the left-hand margin.	Examiner only

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