Surname	Centre Number	Candidate Number
Other Names		0

GCSE – NEW

3430UA0-1

S18-3430UA0-1

SCIENCE (Double Award)

Unit 1: BIOLOGY 1
HIGHER TIER

MONDAY, 11 JUNE 2018 – MORNING

1 hour 15 minutes

For Examiner's use only		
Question	**Maximum Mark**	**Mark Awarded**
1.	**6**	
2.	**9**	
3.	**6**	
4.	**6**	
5.	**9**	
6.	**10**	
7.	**6**	
8.	**8**	
Total	**60**	

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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. 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.

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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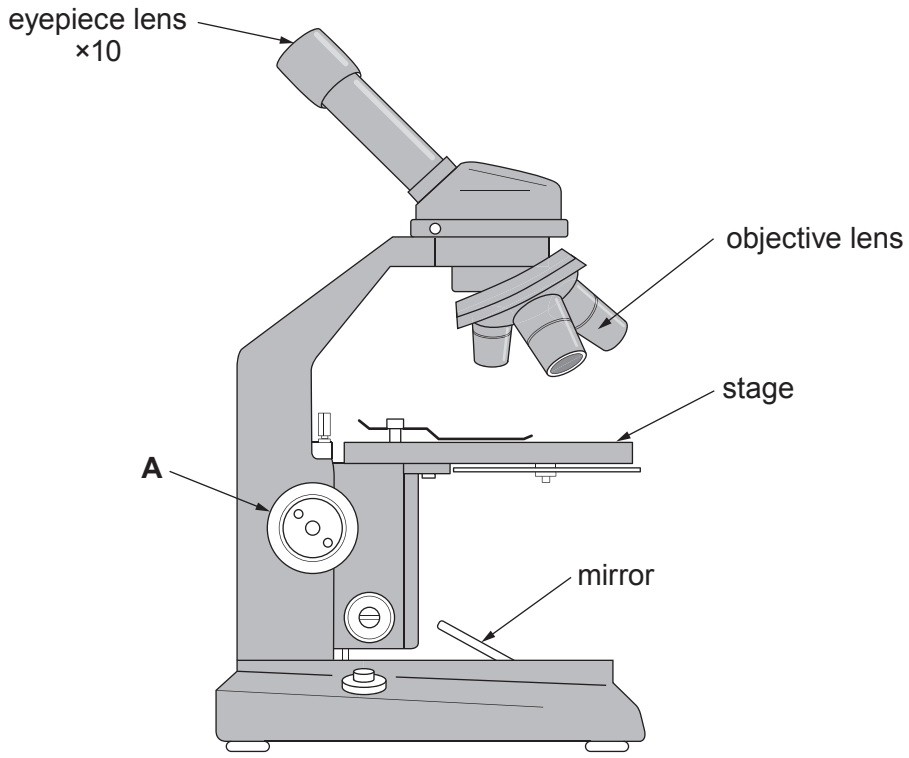
Answer **all** *questions.*

1. Rhys was asked by his teacher to set up a light microscope so that he could view some cells at a magnification of ×100. The microscope had three objective lenses of ×4, ×10 and ×40 magnifications. Rhys was also given a prepared slide of muscle cells.



(a) Explain how Rhys could view the muscle cells at a magnification of ×100. [2]

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(b) State the function of structure **A** on the diagram. [1]

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(c) When Rhys viewed the muscle cell under the microscope he could see that the cells were not found on their own, but were grouped together in large numbers.

(i) Muscle cells are described as being specialised cells. State the advantage to the organism of having specialised cells. [1]

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(ii) State the name given to a large number of the same cells grouped together. [1]

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(d) In biology, what is meant by the term organ? [1]

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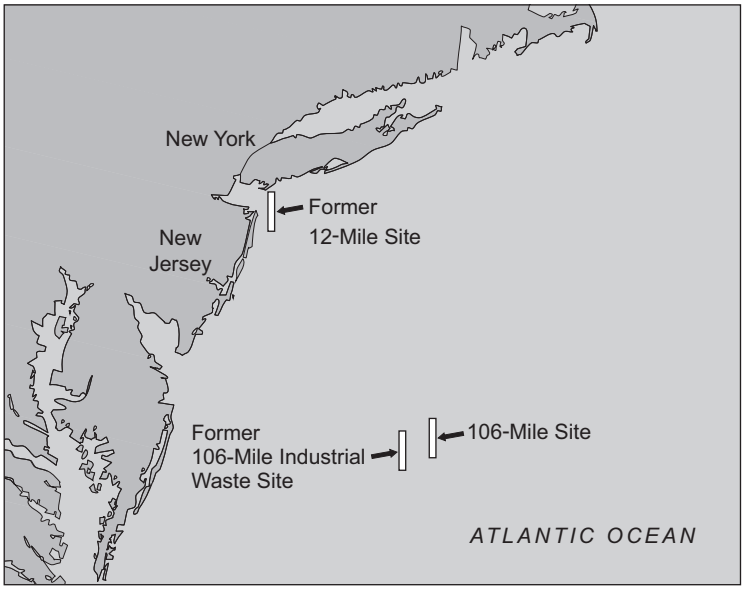
2. In the past, many countries, including the UK, have disposed of sewage sludge in the open ocean. A famous example of this practice is the '106 mile' dump site in the North West Atlantic. This site, 106 miles off the east coast of the USA, served the populations of New York and New Jersey. Prior to the use of the '106 mile' dump site sewage sludge was disposed of at the '12 mile' dump site.

(All data from the US Environmental Protection Agency Report to Congress Sept 1995)

Map **1** showing the east coast of the USA together with disposal sites



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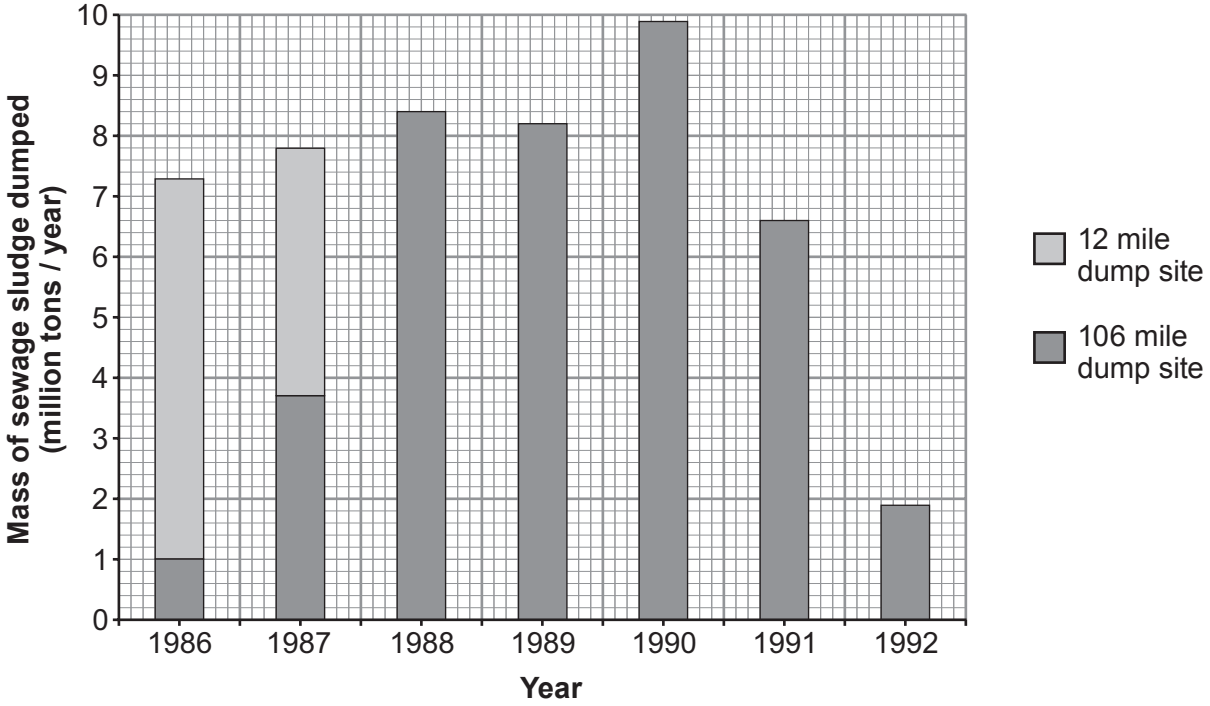
Graph showing the annual disposal of sewage sludge at the '12 mile' and '106 mile' dump sites from 1986 to 1992.



(a) (i) Calculate the total mass of sewage sludge disposed of at the '12 mile' dump site in 1986 and 1987. [2]

total mass of sewage sludge = ... million tons

(ii) What was the final year in which sewage sludge was disposed of at the '12 mile' dump site? [1]

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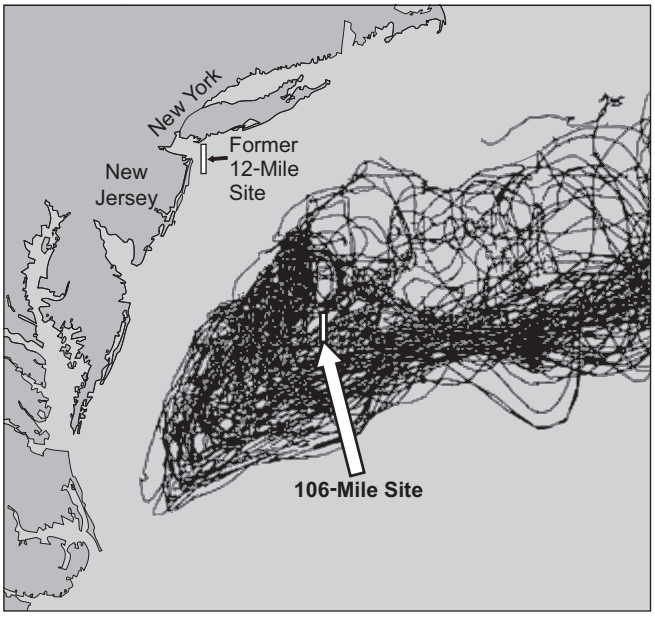
(iii) The US Environmental Protection Agency released buoys into the ocean at the 106 mile dump site. They used satellites to track the movement of the buoys between 1989 and 1992.

drifting buoy tracked by satellite

Map **2** showing the movement of buoys



Use the information in map **2** to suggest why it was decided to select a sewage dump site 106 miles off the east coast of the USA and to close the '12 mile' dump site. [2]

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(b) Of the sewage sludge which is dumped, 20 – 70% reaches the sea bed. Here the oxygen consumed by living organisms increases greatly. Explain why this happens. [3]

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(c) Close to the '106 mile' sewage dump site is the former '106 mile' **industrial** waste dump site. (See map **1** on page 4). Name **one** group of industrial wastes which you would expect to find at this site. [1]

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3. Describe the functions of bile and lipase in the breakdown of fats. [6 QER]

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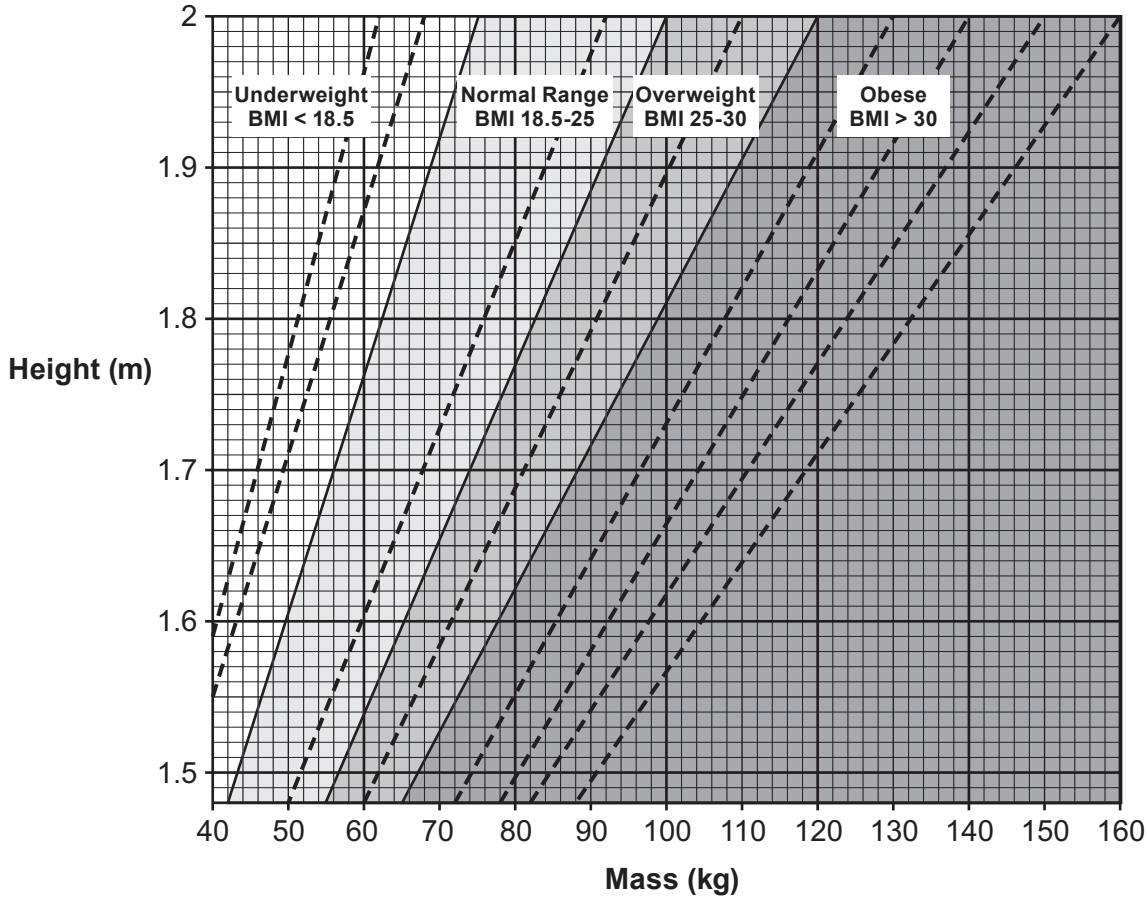
4. The Body Mass Index (BMI) is one way of measuring whether a person is a healthy mass for their height. The result gives an indication of whether the person is a healthy mass, and if not, how overweight or underweight they are.
The BMI is calculated from the mass and height of a person. It is calculated using the following equation:

$$\text{BMI} = \frac{\text{body mass}}{\text{height}^2}$$

where body mass is measured in kilograms and height in metres.

The chart shows the BMI categories based on the World Health Organisation data. The dashed lines represent subdivisions within a major category. For example, the underweight category is subdivided into severe, moderate and mild.



Source: Calculator.net

(a) From the chart, state how many subdivisions there are within the obese category. [1]

number of subdivisions in the obese category = ...

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(b) The table below shows some biometric data for three teachers at a school.

Teacher	Mass (kg)	Height (m)	BMI	BMI category
Iorwerth	82.4	1.56	33.9	obese
Sharon	55.1	1.71	18.8	.....
Peter	95.3	1.84	.....	.....

(i) Calculate the BMI for Peter and **write the answer in the table**. [2]

Space for working.

(ii) Use the chart opposite to allocate a major BMI category to Sharon and Peter and **write the answer in the table** above. [1]

(c) Iorwerth wants to reduce his BMI. State **two** ways in which he could alter his diet in order to achieve this. [2]

I. .....

II. .....

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5. A hen's egg is a single cell which is surrounded by a calcium carbonate shell.
Six hen's eggs were soaked in 4% ethanoic acid for 24 hours to dissolve their shells. After this time each egg is still intact as it is surrounded by a cell membrane. The initial masses of the 'naked eggs' (eggs without shells) were recorded.

'naked egg'

The six 'naked eggs' were each placed in sucrose (sugar) solutions of different concentrations and left for 24 hours. After this time the final masses of the 'naked eggs' were recorded.

Results table

Egg number	Concentration of sucrose solution (%)	Initial mass (g)	Final mass (g)	Change in mass (g)	% change in mass
1	0	61.5	67.2	5.7	9.3
2	5	64.3	68.9	4.6	7.2
3	10	59.8	63.2	3.4	5.7
4	15	60.7	59.8	–0.9	–1.5
5	20	62.6	59.9	–2.7	–4.3
6	25	60.9	56.1	–4.8	.....

(a) **Complete the table** above by calculating the % change in mass for egg number **6**. [2]
Space for working.

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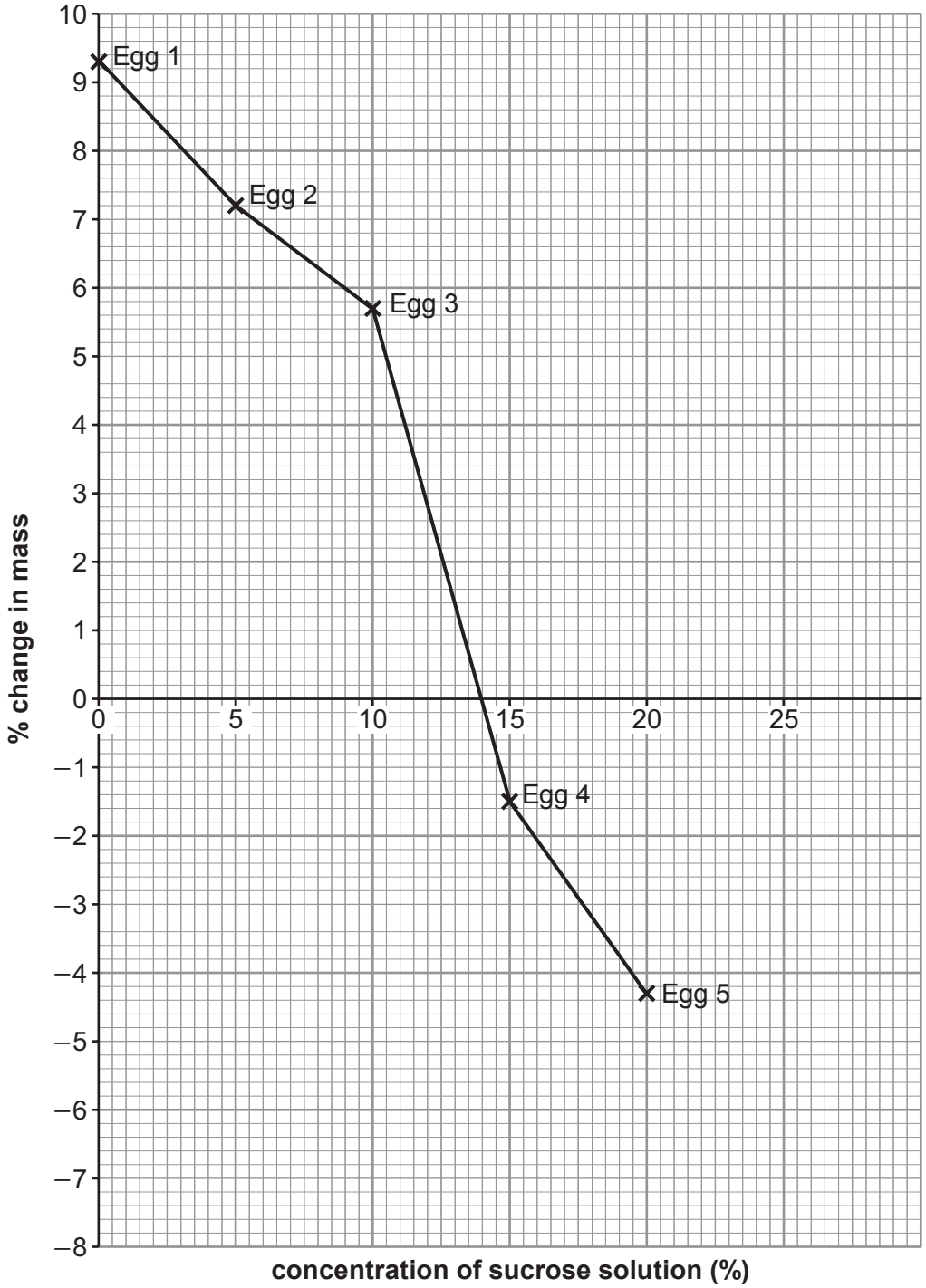
(b) In the graph below the % change in mass of the 'naked eggs' is plotted against the concentration of sucrose solution.



(i) **Complete** the **graph** by adding the percentage change in mass for egg number **6**. [1]

(ii) From the graph state the concentration of sucrose solution where there was no net movement of water. [1]

concentration of sucrose solution = ... %

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(c) Explain the results for egg number **3** and egg number **5**. [4]

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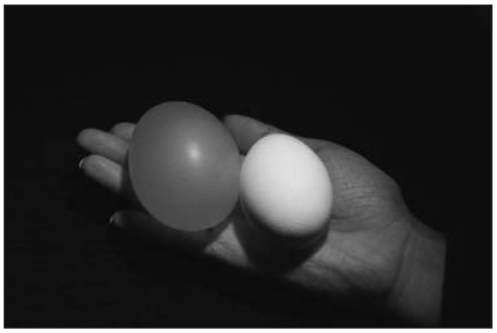
(d) The photograph below shows a complete hen's egg on the right and one of the 'naked eggs', used in this experiment, on the left.

Suggest a concentration of sucrose solution in which this 'naked egg' was kept. [1]



suggested concentration of sucrose solution = ... %

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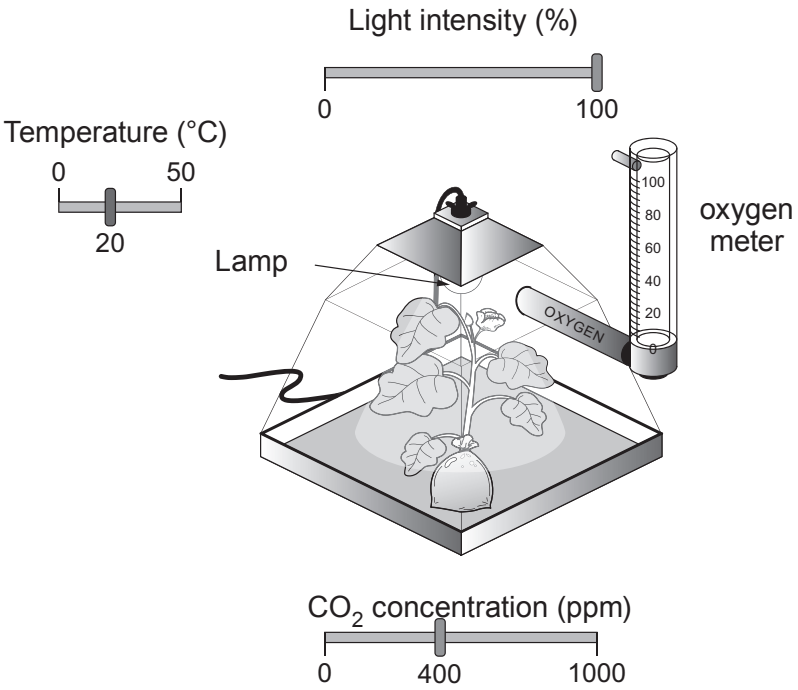
6. In a classroom exercise some students used a computer simulation to investigate the factors affecting the rate of photosynthesis. A well-watered plant, was placed inside a transparent sealed container with a high intensity lamp above the plant. The air in the airtight container was continually monitored in order to measure the rate of O_2 production

- The light intensity of the lamp could be varied between 0 - 100 %.
- The CO_2 concentration of the air inside the sealed container could be varied between 0 – 1000 ppm.
- The temperature inside the sealed container could be varied between 0 – 50 °C.



The table below shows the results obtained by one of the students.

Reading number	Light intensity (%)	Temperature (°C)	CO_2 concentration (ppm)	O_2 production (cm^3/h)
1	0	10	0	0.0
2	20	10	200	3.1
3	40	10	200	3.1
4	40	10	400	3.1
5	40	20	400	34.7
6	60	20	400	41.7
7	80	20	400	41.7
8	100	25	400	41.7
9	100	25	600	47.3

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(a) Explain how oxygen production can be used as a measure of the rate of photosynthesis. [3]

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(b) Explain why oxygen production remains at 3.1 cm^3/h for readings **2**, **3 and 4**. [2]

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(c) Identify the limiting factor for readings **6**, **7**, **8 and 9** and explain your answer. [2]

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(d) State why the container must be sealed. [1]

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(e) Sian and Dafydd are students who carried out the computer simulation. Sian suggested that they try to set up a 'live version' of the apparatus in the laboratory. Dafydd said that if they did this, a problem could arise which would affect the validity of the experiment. Suggest the problem that may arise and how this could be solved. [2]

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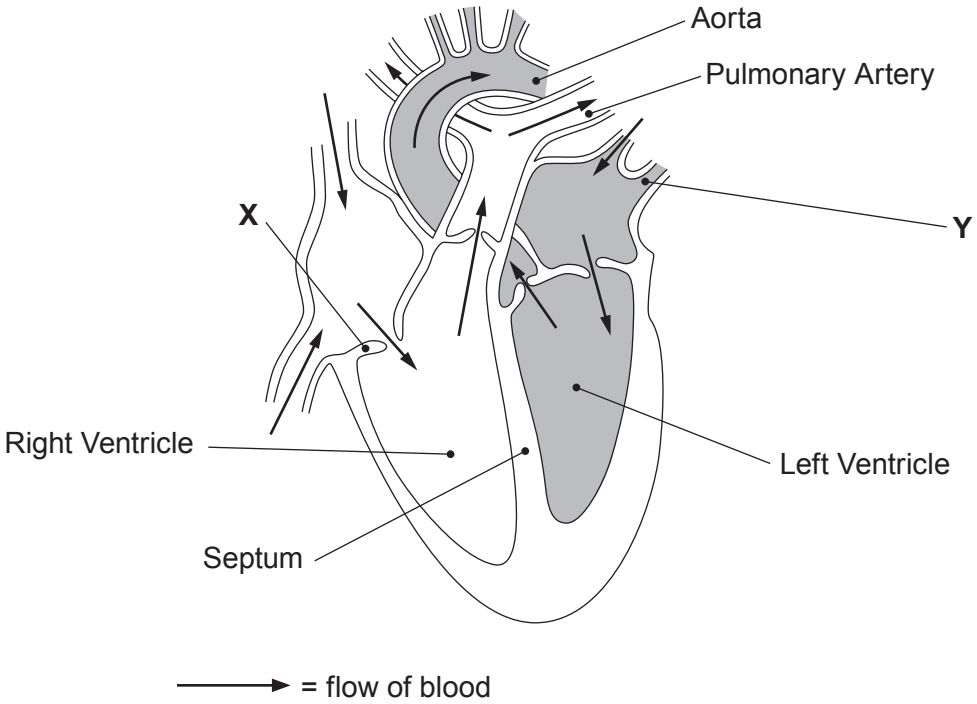
7. The diagram shows a section through the human heart.



(a) State the name of structures labelled **X** and **Y** on the diagram. [2]

X .....

Y .....

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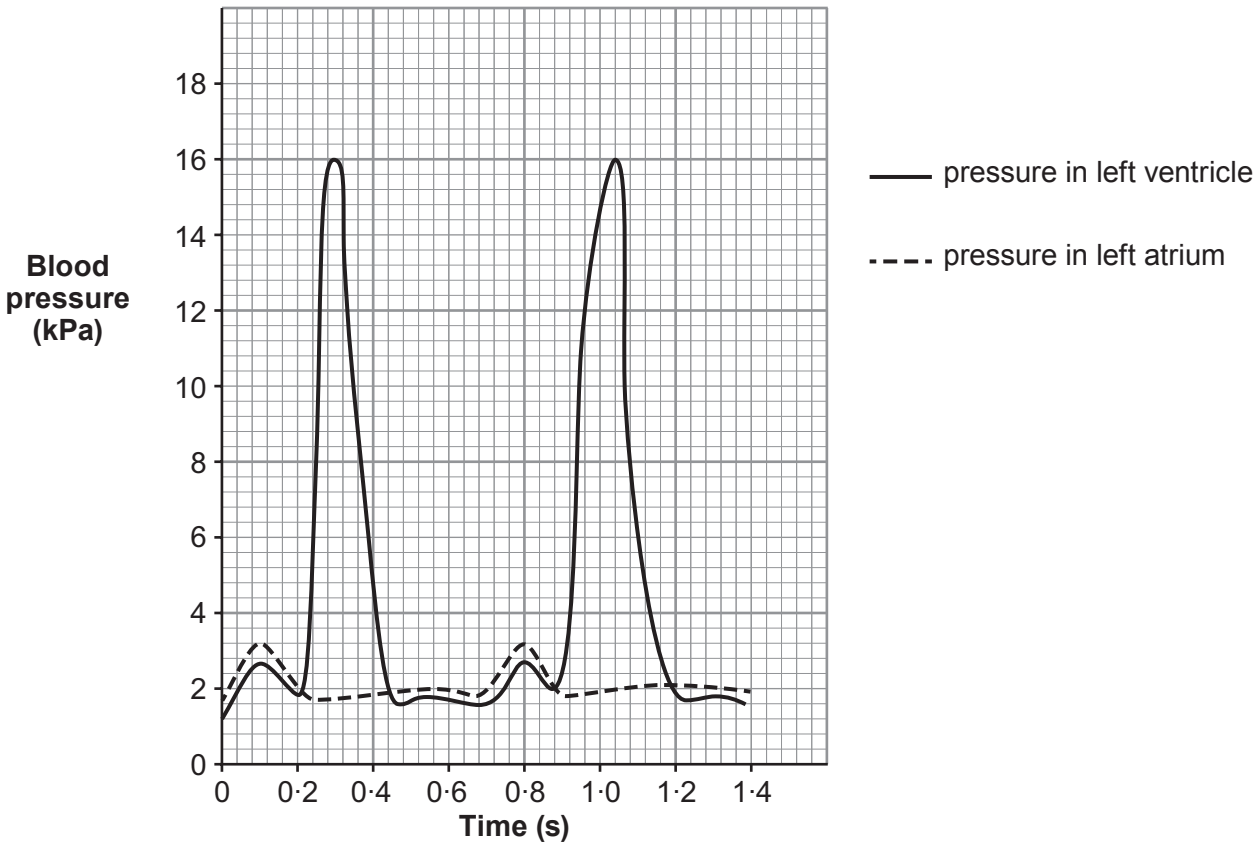
(b) The walls of the atria and ventricles are of different thicknesses and are made of muscle. When the muscle contracts blood is pumped from one part of the heart to another or is pumped out of the heart.

The chart below shows the change in the blood pressure in the left atrium and left ventricle as they contract.



(i) State the maximum blood pressure in: [1]

I. left atrium ..... kPa

II. left ventricle ..... kPa

(ii) State how the blood pressure in the right ventricle would be different to that in the left. Give the reason for this difference and explain its significance. [3]

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8. The word equation for aerobic respiration is shown below.

glucose + oxygen ⟶ carbon dioxide + water + ATP

(a) In the space below state the word equation for anaerobic respiration in human cells. [1]

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(b) Explain why anaerobic respiration is less efficient than aerobic respiration. [2]

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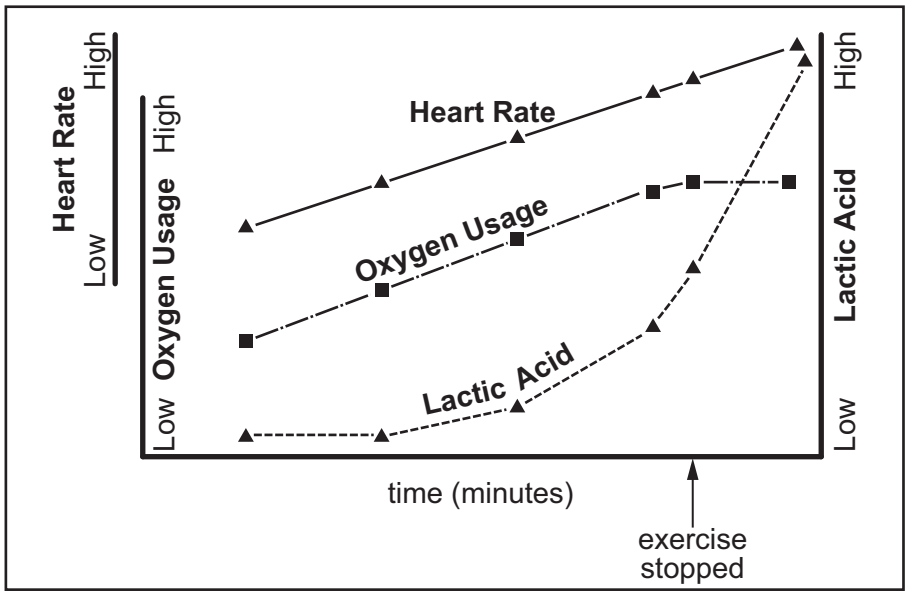
(c) An Olympic athlete exercised on a treadmill. During the exercise her blood oxygen and lactic acid levels were continuously monitored as was her heart rate.
The athlete's fitness coach knew the maximum intensity of exercise she could perform (100%). The athlete increased the intensity of exercise until she reached the maximum intensity of exercise she could perform (100%). She then stopped the exercise but her heart rate and blood levels continued to be monitored.
The graph below appeared on a computer screen.



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(i) Explain why, even after exercise stops, the athlete continues to take in and use large volumes of oxygen. [2]

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(ii) Explain why the heart rate remains high after exercise stops. [1]

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(d) The ability of oxygen to pass into the capillaries around the alveoli decreases with increasing altitude. Above 1500 m physical activity becomes more difficult.
In 1968, the Olympic Games were held in Mexico City (altitude 2268 m). Athletes and their coaches realised the difficulty of competing at the altitude of Mexico City and many of them arrived, and started training, three months before the games started. As a result of this long period of acclimatisation to altitude, the number of red blood cells per unit volume of blood in the athlete's body increased. This is one of the effects of living and working at altitude.
Explain the advantage, to the athletes, of the increased number of red blood cells per unit volume of blood. [2]

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