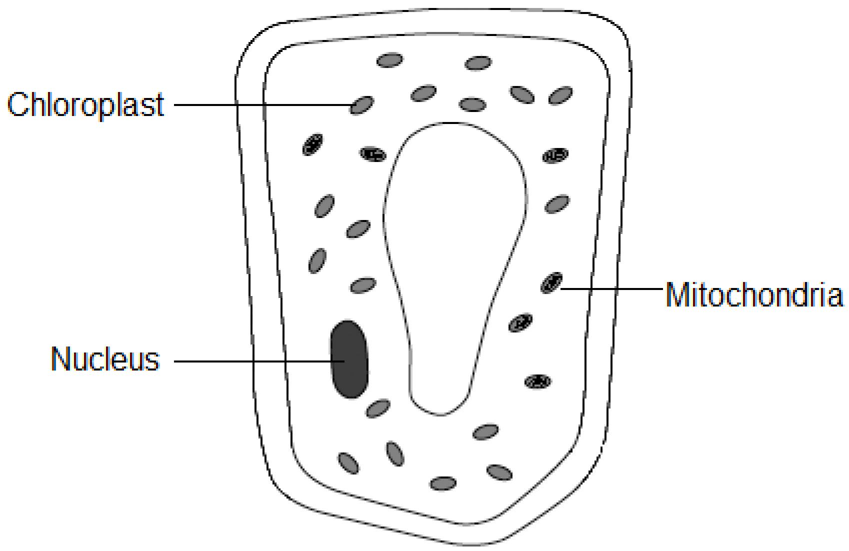
4-4 Bioenergetics –Trilogy

1.0 **Figure 1** shows a plant cell.

Figure 1



1.1 Draw one line from each part of the cell to its function.

[3 marks]

Part of the cell	Function
	Where most of the chemical reactions take place
Nucleus	Absorbs light energy to make food
Chloroplast	Carries out respiration
Mitochondria	Controls the activities of the cell

1.2 Respiration takes place in the cell.

Use a word from the list to complete the sentence.

[1 mark]

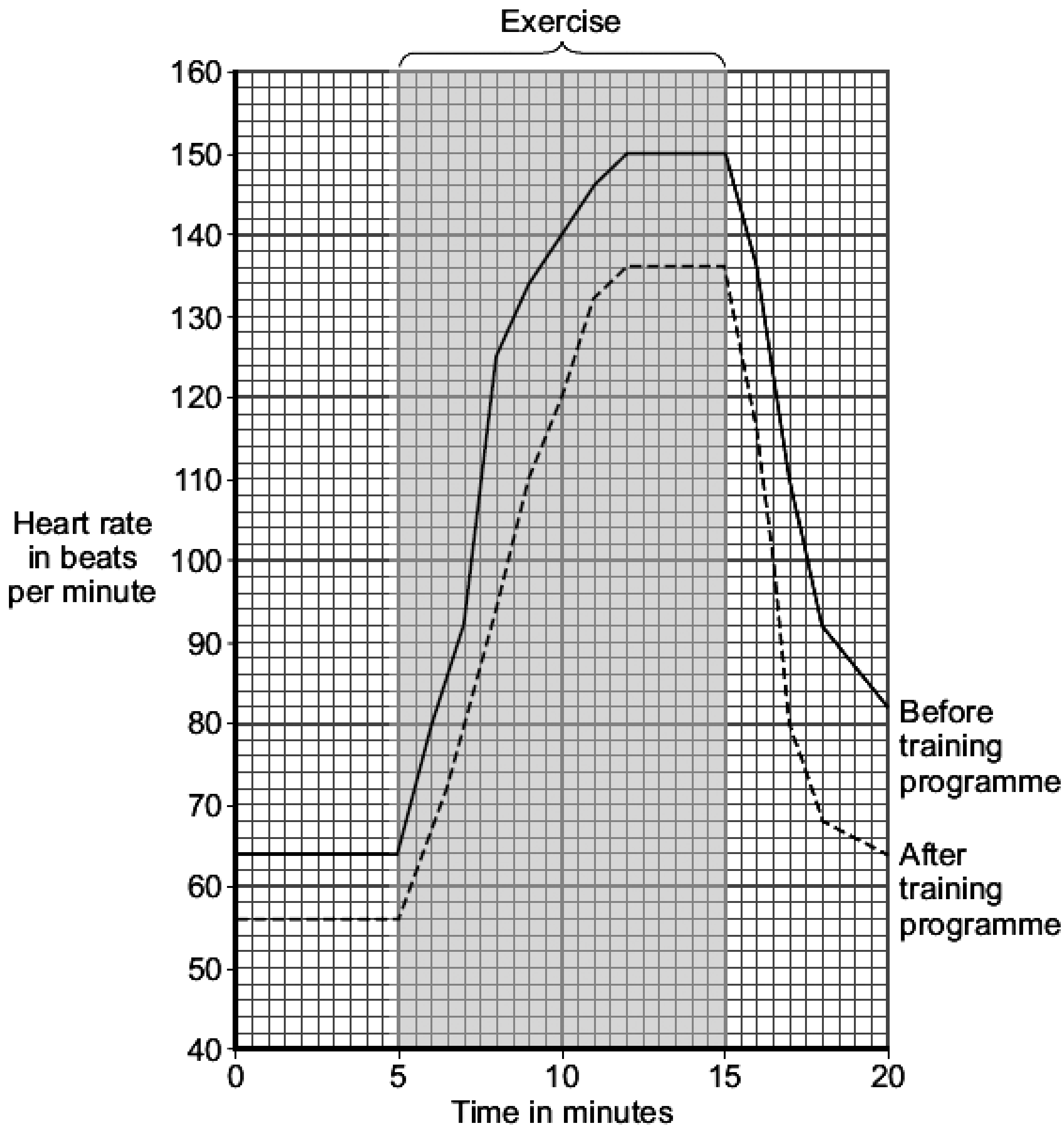
amino acids **energy** **glucose** **oxygen**

All cells use respiration to release ________________________________.

2.0 An athlete did a 6-month training programme.

Figure 2 shows the effect of the same amount of exercise on his heart rate before and after the training programme.

Figure 2



2.1 What was the minimum heart rate of the athlete before the training programme?

[1 mark]

Minimum heart rate = ____________________________beats per minute

2.2 Give **two** differences between the heart rate of the athlete before and after the training programme.

[2 marks]

____

____

2.3 Which **two** substances need to be supplied to the muscles in larger amounts during exercise?

Choose **two** substances from the list.

[2 marks]

Carbon dioxide   Glucose   Lactic acid   Oxygen   Urea

2.4 Use **Figure 2** to find the heart rate of the **trained** athlete 3 minutes after he stopped exercising.

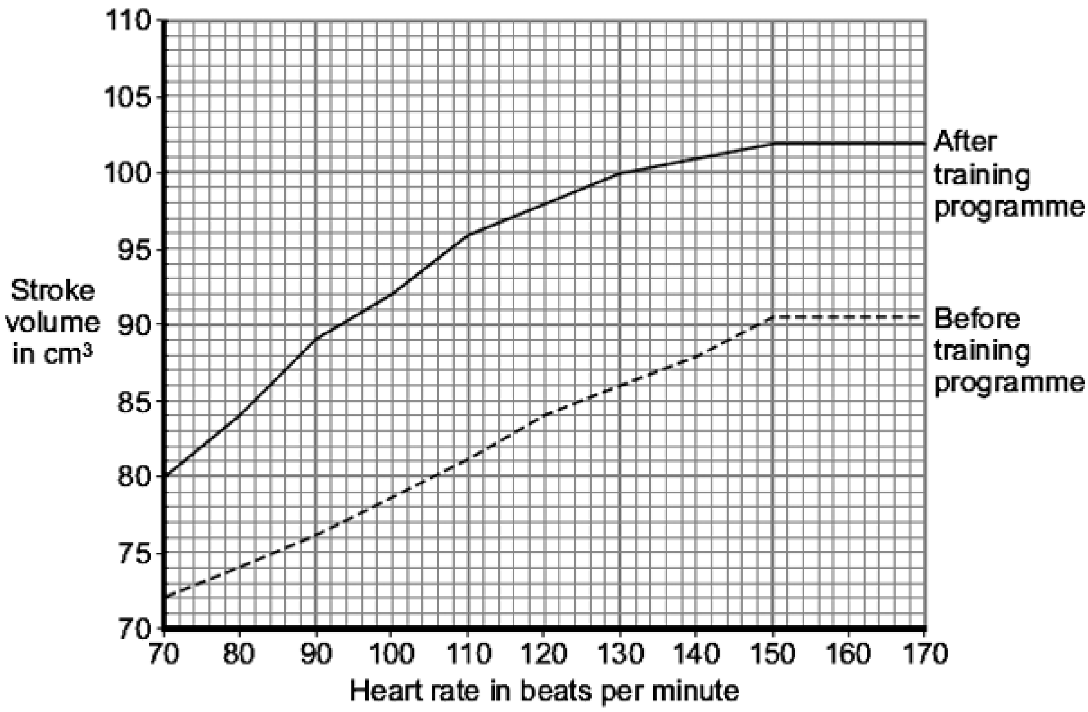
[1 mark]

Heart rate = __________________________ beats per minute

The stroke volume of the heart is the volume of blood pumped out of the left side of the heart in one heart beat.

Figure 3 shows the relationship between the stroke volume and the heart rate before and after the athlete did the training programme.

Figure 3



2.5 The **cardiac output** is calculated using the following equation:

cardiac output = heart rate × stroke volume

Calculate the cardiac output of the athlete **after** training, 8 minutes after the start of the exercise. Use information from **Figure 2** and **Figure 3.**

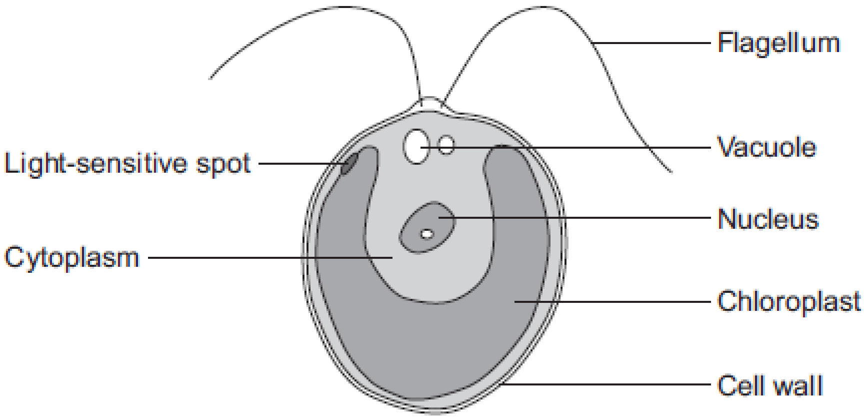
[2 marks]

Show clearly how you work out your answer.

Cardiac output = ___________________ cm^3 blood per minute

3.0 **Figure 4** shows a single-celled alga which lives in fresh water.

Figure 4



3.1 Which part of the cell labelled above is made of cellulose?

[1 mark]

____

3.2 Water enters and leaves the algal cell.

What is the name of the process by which water moves into cells?

[1 mark]

____

3.3 Describe what happens to the algal cell as water moves into the cell.

[1 mark]

____

3.4 The alga can photosynthesise.

Complete the **word** equation for photosynthesis.

[2 marks]

$$\text{water} + \ldots\ldots\ldots\ldots\ldots \xrightarrow{\text{Light energy}} \ldots\ldots\ldots\ldots\ldots + \text{oxygen}$$

3.5 The flagellum helps the cell to move through water.

Scientists think that the flagellum and the light-sensitive spot work together to increase photosynthesis.

Suggest how this might happen.

[2 marks]

____

____

____

____

4.0 This question is about photosynthesis.

4.1 Plants make glucose during photosynthesis.
Some of the glucose is changed into insoluble starch.

What happens to this starch?

[1 mark]

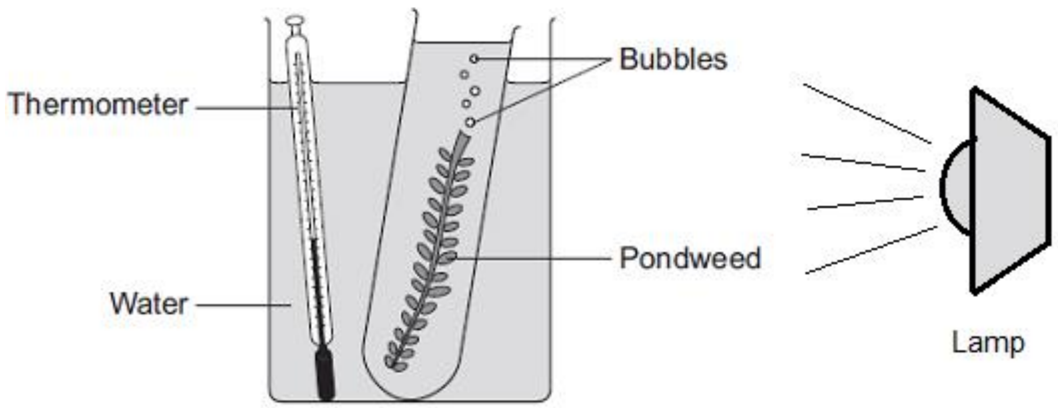
Tick **one** box.

The starch is converted into oxygen.	☐
The starch is stored for use later.	☐
The starch is used to make the leaf green.	☐

4.2 A student investigated the effect of light intensity on the rate of photosynthesis in pondweed.

Figure 5 shows the way the experiment was set up.

Figure 5



The student needed to control some variables to make the investigation fair.
State **two** variables the student needed to control in this investigation.

[2 marks]

___

___

4.3 The bubbles of gas are only produced while photosynthesis is taking place. What **two** measurements would the student make to calculate the rate of photosynthesis?

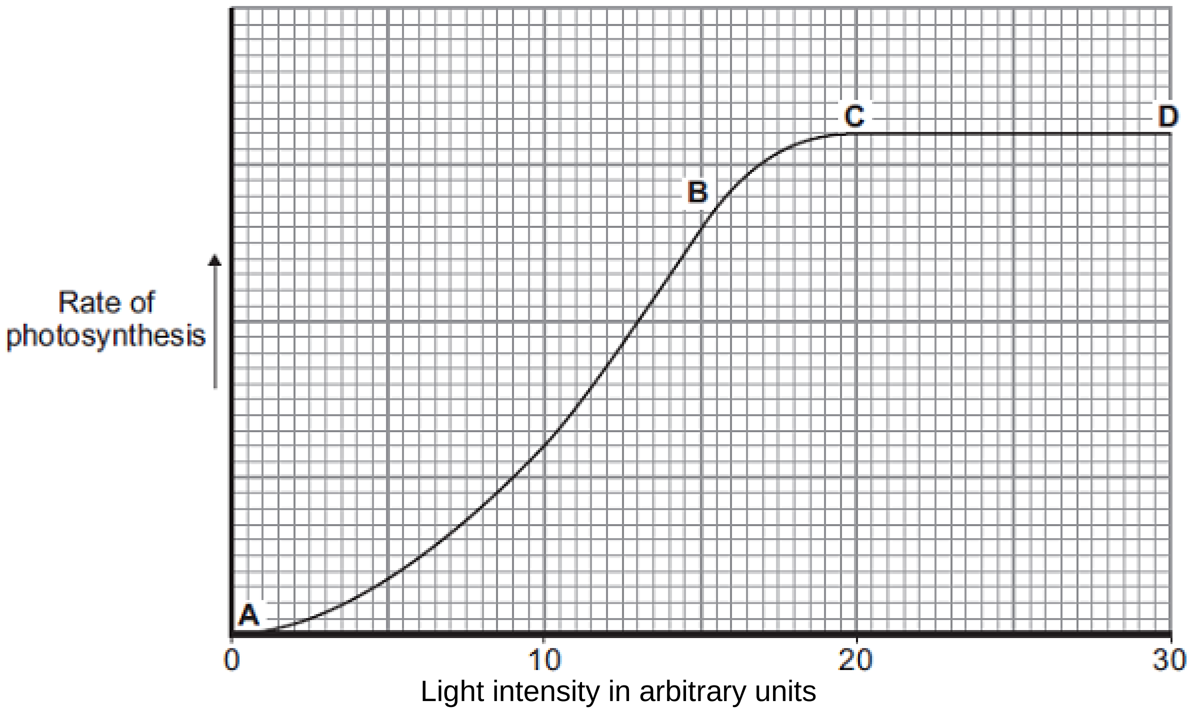
[2 marks]

____

____

4.4 **Figure 6** shows the effect of light intensity on the rate of photosynthesis in the pondweed.

Figure 6



Name the factor that limits the rate of photosynthesis between the points labelled **A** and **B** on the graph.

[1 mark]

____

4.5 Suggest which factor might be limiting the rate of photosynthesis between the points labelled **C** and **D** on the graph.

[1 mark]

____

MARK SCHEME

Qu No.		Extra Information	Marks
1.1	Nucleus – Controls the activities… Chloroplast – Absorbs light energy… Mitochondria – Carries out respiration	1 mark for each correct line mark each line from left hand box two lines from left hand box cancels mark for that box	3
1.2	energy		1

Qu No.		Extra Information	Marks
2.1	64 (beats per minute)		1
2.2	any **two** from: • lower resting pulse • lower rate during exercise • recovers faster after exercise	accept correct use of numbers accept lower pulse rate if neither of the first two marking points awarded, allow 1 mark for 'lower rate'.	2
2.3	glucose oxygen		1 1
2.4	68		1
2.5	(136 × 100.5) = 13,668	Allow 13000 to 13800. if answer incorrect, allow one mark for obvious attempt to read both graphs and multiply	2

Qu No.		Extra Information	Marks
3.1	cell wall		1
3.2	osmosis	allow diffusion	1
3.3	cell becomes turgid / swollen		1
3.4	Carbon dioxide Glucose		1 1
3.5	any **two** from: • light sensitive spot detects light • tells flagellum to move towards light • more light = more photosynthesis		2

Qu No.		Extra Information	Marks
4.1	the starch is stored for use later		1
4.2	any **two** from: • carbon dioxide (concentration) • temperature • light colour / wavelength • pH • size of pondweed / plant • same species / type of pondweed • volume of water in the tube	ignore reference to time allow 1 mark for light if colour is not already awarded. ignore volume of water unqualified	2
4.3	number / amount of bubbles **or** amount of gas / oxygen (relevant reference to) time / named time interval	ignore the bubbles unqualified allow how long it bubbles for do not allow time bubbles start / stop ignore speed / rate of bubbling ignore instruments do not allow other factors e.g. temperature accept how many bubbles per minute for 2 marks	1 1
4.4	Light intensity		1
4.5	Temperature/carbon dioxide / CO_2	Allow heat allow CO2 do not allow CO^2	1