

Name:

Date:

B4 - Test 2
BIOENERGETICS

GCSE
AQA
BIOLOGY

Mark

Grade

Materials

For this paper you must have:

- Ruler
- Pencil and Rubber
- Scientific calculator, which you are expected to use when appropriate

Instructions

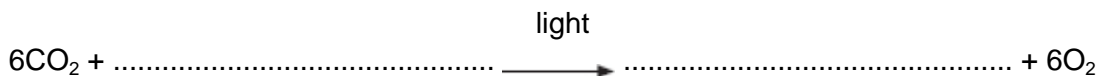
- Answer all questions
- Answer questions in the space provided
- All working must be shown

Information

- The marks for the questions are shown in brackets

1 Photosynthesis needs light.

(a) Complete the **balanced symbol** equation for photosynthesis.



(2)

(b) A green chemical indicator shows changes in the concentration of carbon dioxide (CO₂) in a solution.

The indicator solution is **green** when the concentration of CO₂ is normal.

The indicator solution turns **yellow** when the concentration of CO₂ is high.





The indicator solution turns **blue** when the concentration of CO₂ is very low or when there is no CO₂.

The indicator solution does not harm aquatic organisms.

Students investigated the balance of respiration and photosynthesis using an aquatic snail and some pondweed.

The students set up four tubes, **A**, **B**, **C** and **D**, as shown in the table below.

The colour change in each tube, after 24 hours in the light, is recorded.

Tube A	Tube B	Tube C	Tube D
			
Indicator solution only	Indicator solution + pondweed	Indicator solution + snail	Indicator solution + pondweed + snail
Stays green	Turns blue	Turns yellow	Stays green

(i) What is the purpose of **Tube A**?

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(1)

(ii) Explain why the indicator solution in **Tube C** turns yellow.

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(2)

(iii) Predict the result for **Tube D** if it had been placed in the dark for 24 hours and **not** in the light.

Explain your prediction.

Prediction.....

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Explanation.....

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(3)

(Total 8 marks)

2

(a) A student carried out the following investigation using a plant with variegated leaves. A variegated leaf has green and white stripes.

The student:

- left the plant in the dark for 3 days to remove the starch
- fixed two pieces of card to a leaf on the plant
- left the plant in the light for 2 days
- removed the leaf from the plant
- tested the leaf for starch.

Figure 1 shows how the two pieces of card were attached to the leaf.

Figure 1

Leaf without card

Leaf with card

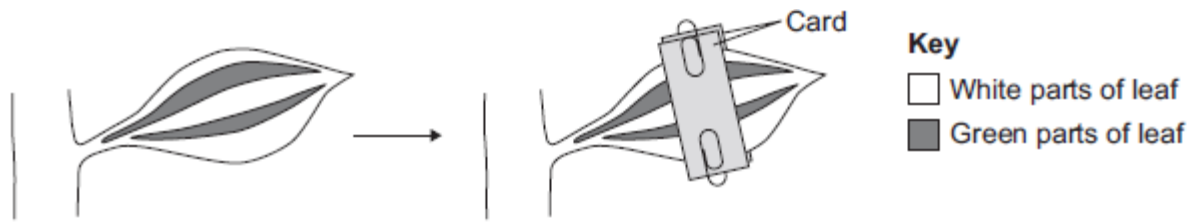
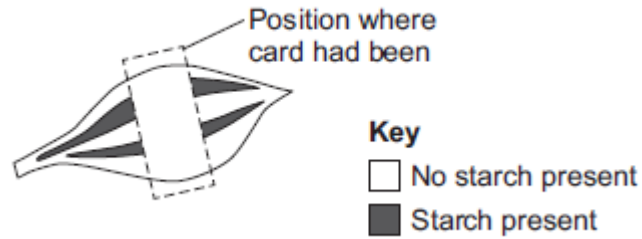


Figure 2 shows the same leaf after 2 days in the light. The leaf has been tested for starch.

Figure 2



Give **two** conclusions from this investigation.

Tick (✓) **two** boxes.

Carbon dioxide is needed for photosynthesis.

Chlorophyll is needed for photosynthesis.

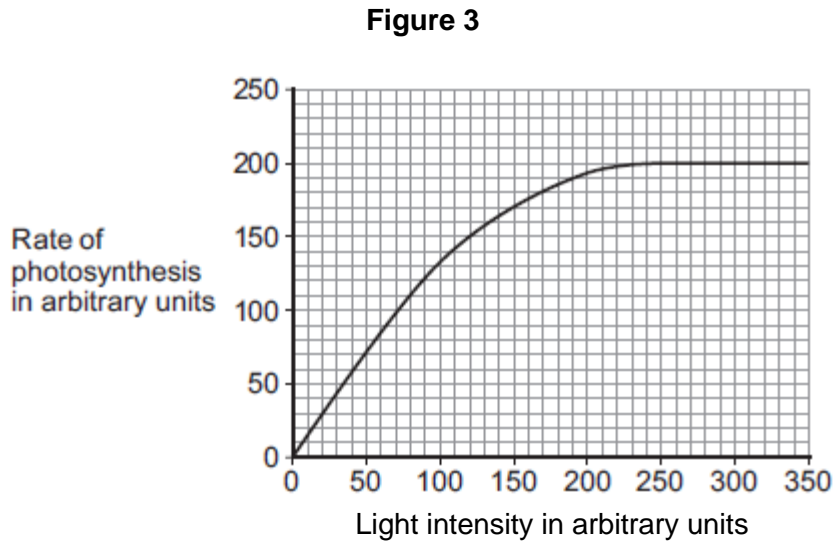
Light is needed for photosynthesis.

Water is needed for photosynthesis.

(2)

(b) Scientists investigated the effect of light intensity on the rate of photosynthesis.

Figure 3 shows the scientists' results.



Describe the effect of increasing light intensity on the rate of photosynthesis. You should include numbers from **Figure 3** in your description.

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(3)

(c) At a light intensity of 250 arbitrary units, light is **not** a limiting factor of photosynthesis.

(i) What is the evidence for this in **Figure 3**?

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(1)

(ii) Give **two** factors that could be limiting the rate of photosynthesis at a light intensity of 250 arbitrary units.

1

2

(2)

(Total 8 marks)

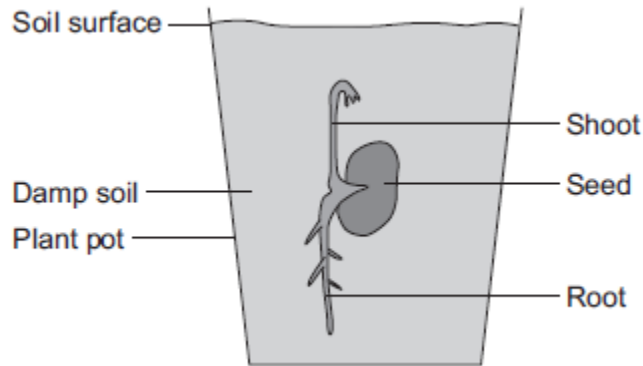
3

A student investigated growth in plants.

The student:

- planted a seed in damp soil in a plant pot
- put the plant pot in a dark cupboard.

The image below shows the result after 5 days.



(a) Draw a ring around the correct answer to complete each sentence.

(i) After the 5 days, the root had grown

away from water.
in the direction of the force of gravity.
towards light.

(1)

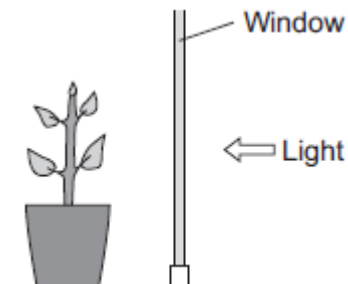
(ii) After the 5 days, the shoot had grown

against the force of gravity.
away from light.
towards water.

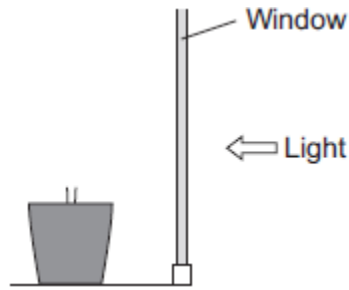
(1)

(b) After the plant had grown, the student put the plant pot by a window with lots of light.

The illustration below shows this.



- (i) Complete the diagram below to show the appearance of the student's plant after 20 days by the window.



(1)

- (ii) Explain the advantage to the plant of growing in the way that you have drawn in part (b)(i).

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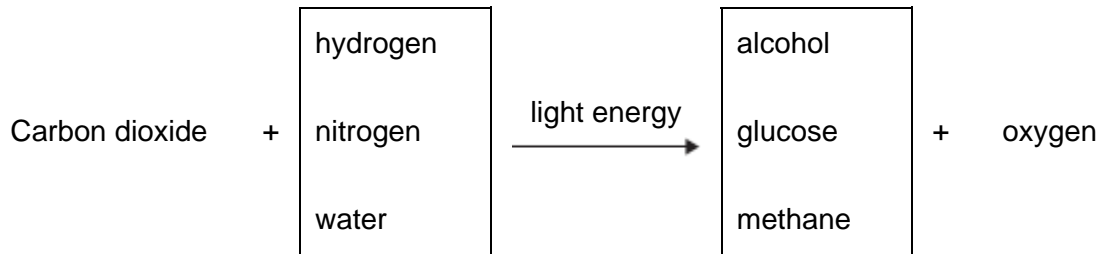
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(2)

(Total 5 marks)

4

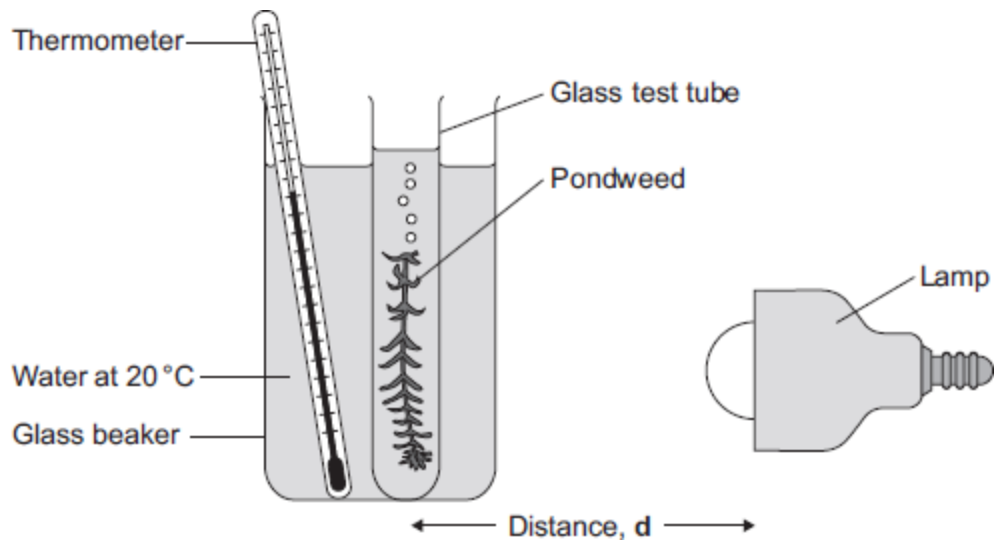
- (a) Complete the equation for photosynthesis. Draw a ring around each correct answer.



(2)

Some students investigated the effect of light intensity on the rate of photosynthesis in pondweed.

The diagram shows the apparatus the students used.



The closer the lamp is to the pondweed, the more light the pondweed receives.

The students placed the lamp at different distances, d , from the pondweed.

They counted the number of bubbles of gas released from the pondweed in 1 minute for each distance.

- (b) A thermometer was placed in the glass beaker.

Why was it important to use a thermometer in this investigation?

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(3)

- (c) The students counted the bubbles four times at each distance and calculated the correct mean value of their results.

The table shows the students' results.

Distance d in cm	Number of bubbles per minute				
	1	2	3	4	Mean
10	52	52	54	54	53
20	49	51	48	52	50
30	32	30	27	31	30
40	30	10	9	11	

- (i) Calculate the mean number of bubbles released per minute when the lamp was 40 cm from the pondweed.

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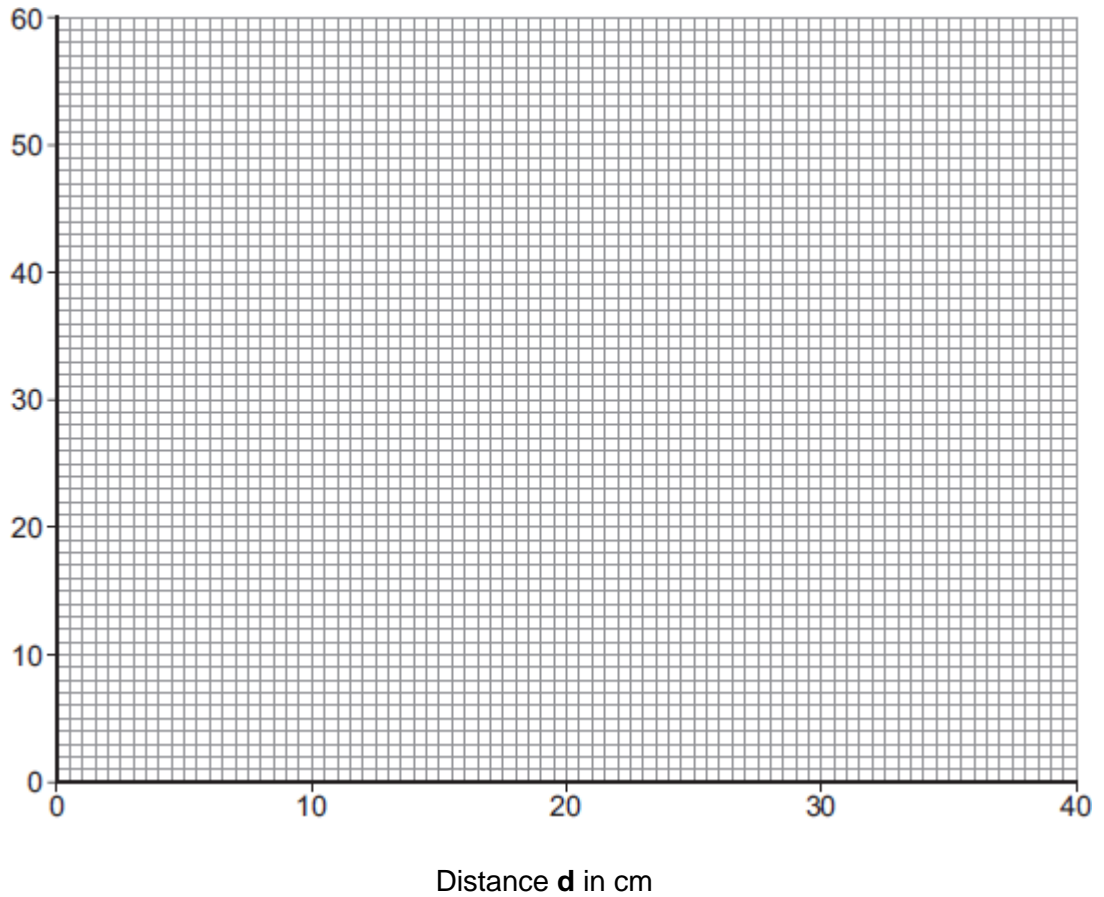
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Mean number of bubbles at 40 cm =

(2)

(ii) On the graph paper below, draw a graph to show the students' results:

- add a label to the vertical axis
- plot the **mean values** of the number of bubbles
- draw a line of best fit.



(4)

(iii) One student concluded that the rate of photosynthesis was inversely proportional to the distance of the lamp from the plant.

Does the data support this conclusion?

Explain your answer.

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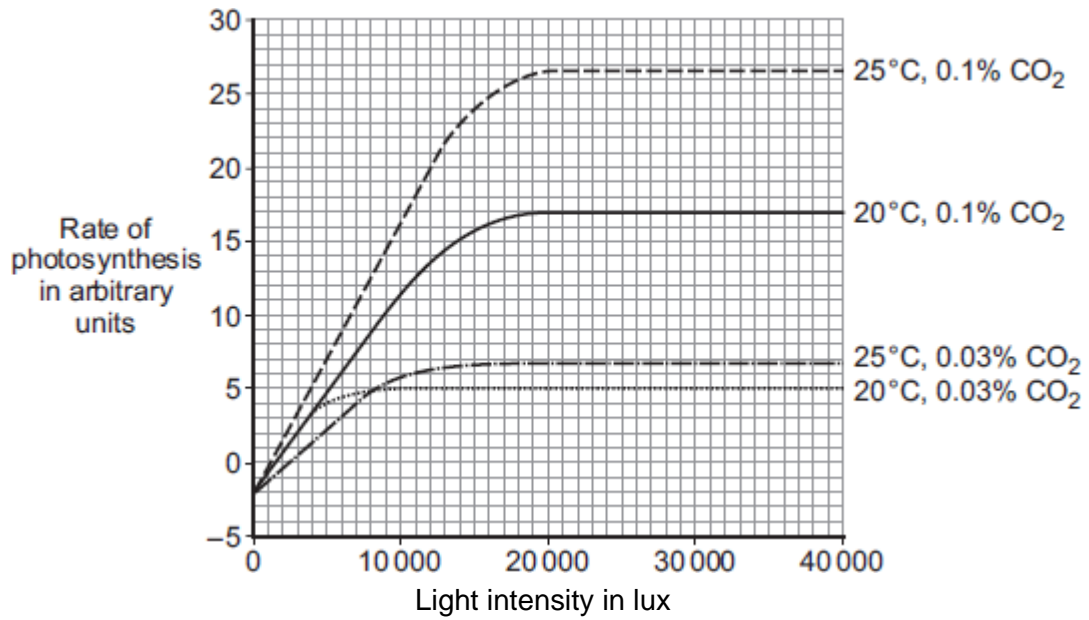
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(2)

- (d) Light intensity, temperature and concentration of carbon dioxide are factors that affect the rate of photosynthesis.

Scientists investigated the effects of these three factors on the rate of photosynthesis in tomato plants growing in a greenhouse.

The graph below shows the scientists' results.



A farmer in the UK wants to grow tomatoes commercially in a greenhouse.

The farmer read about the scientists' investigation.

During the growing season for tomatoes in the UK, natural daylight has an intensity higher than 30 000 lux.

The farmer therefore decided to use the following conditions in his greenhouse during the day:

- 20°C
- 0.1% CO₂
- no extra lighting.

Suggest why the farmer decided to use these conditions for growing the tomatoes.

You should use information from the scientists' graph in your answer.

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(4)
(Total 17 marks)

5

Green plants can make glucose.

(a) Plants need energy to make glucose.

How do plants get this energy?

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(2)

(b) Plants can use the glucose they have made to supply them with energy.

Give **four** other ways in which plants use the glucose they have made.

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(4)

(Total 6 marks)

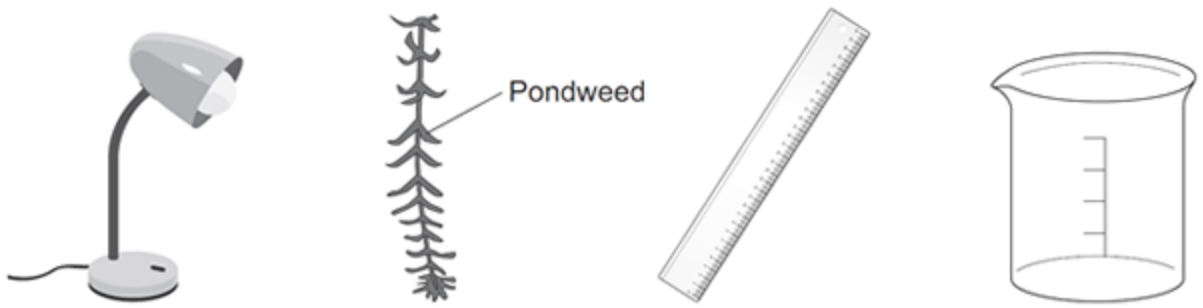
6

In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.

Light intensity, carbon dioxide concentration and temperature are three factors that affect the rate of photosynthesis.

How would you investigate the effect of **light intensity** on the rate of photosynthesis?

The image below shows some of the apparatus you might use.



Not to scale

You should include details of:

- how you would set up the apparatus and the materials you would use
- the measurements you would make
- how you could make this a fair test.

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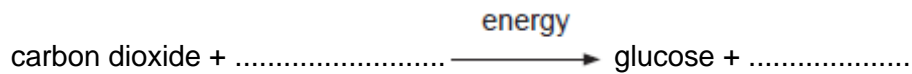
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(Total 6 marks)

7

Photosynthesis uses carbon dioxide to make glucose.

(a) (i) Complete the equation for photosynthesis.



(2)

(ii) What type of energy does a plant use in photosynthesis?

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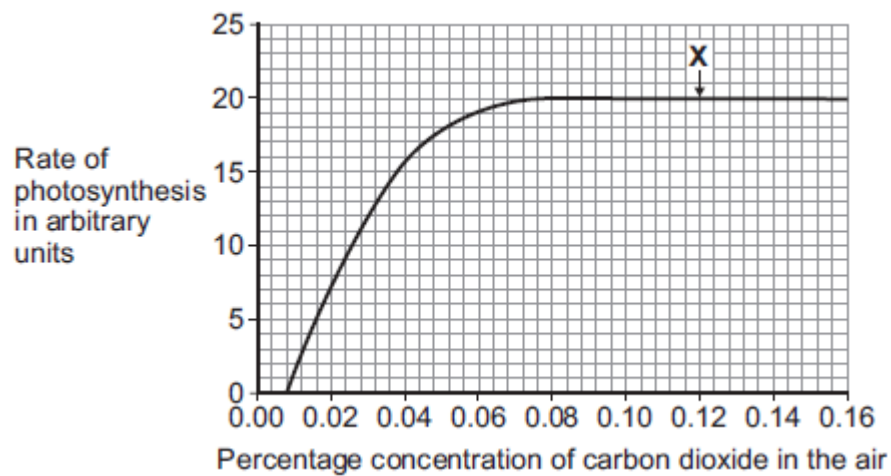
(1)

(iii) Which part of a plant cell absorbs the energy needed for photosynthesis?

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(1)

(b) The graph shows the effect of the concentration of carbon dioxide on the rate of photosynthesis in tomato plants at 20 °C.



- (i) What is the maximum rate of photosynthesis of the tomato plants shown in the graph?

..... arbitrary units

(1)

- (ii) At point **X**, carbon dioxide is **not** a limiting factor of photosynthesis.

Suggest **one** factor that is limiting the rate of photosynthesis at point **X**.

.....

(1)

- (c) A farmer plans to grow tomatoes in a large greenhouse.

The concentration of carbon dioxide in the atmosphere is 0.04%.

The farmer adds carbon dioxide to the greenhouse so that its concentration is 0.08%.

- (i) Why does the farmer use 0.08% carbon dioxide?

Tick (✓) **one** box.

To increase the rate of growth of the tomato plants

To increase the rate of respiration of the tomato plants

To increase water uptake by the tomato plants

(1)

(ii) Why does the farmer **not** use a concentration of carbon dioxide higher than 0.08%?

Tick (✓) **two** boxes.

Because it would cost more money than using 0.08%

Because it would decrease the temperature of the greenhouse

Because it would not increase the rate of photosynthesis of the tomato plants any further

Because it would increase water loss from the tomato plants

(2)
(Total 9 marks)