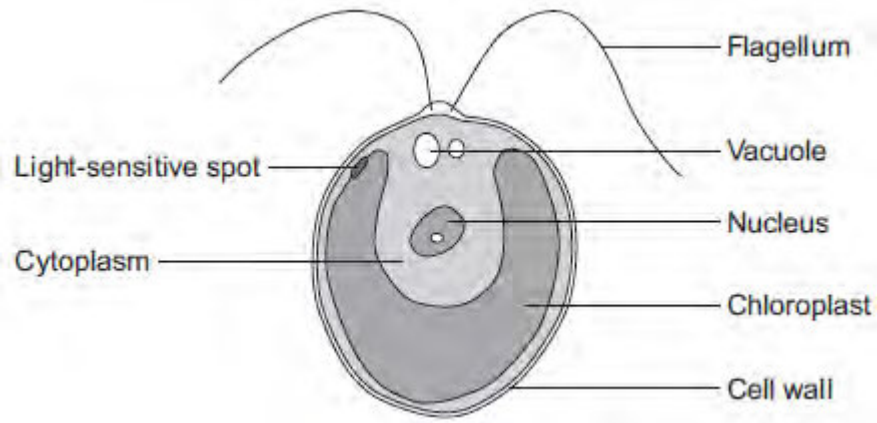
Q1. The diagram below shows a single-celled alga which lives in fresh water.



(a) Which part of the cell labelled above:

(i) traps light for photosynthesis

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(1)

(ii) is made of cellulose?

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(1)

(b) In the freshwater environment water enters the algal cell.

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

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(1)

(ii) Give the reason why the algal cell does not burst.

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(1)

(c) (i) The alga can photosynthesise.

Complete the **word** equation for photosynthesis.

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

(2)

(ii) 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.

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(2)

(d) Multicellular organisms often have complex structures, such as lungs, for gas exchange.

Explain why single-celled organisms, like algae, do **not** need complex structures for gas exchange.

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(3)

(Total 11 marks)

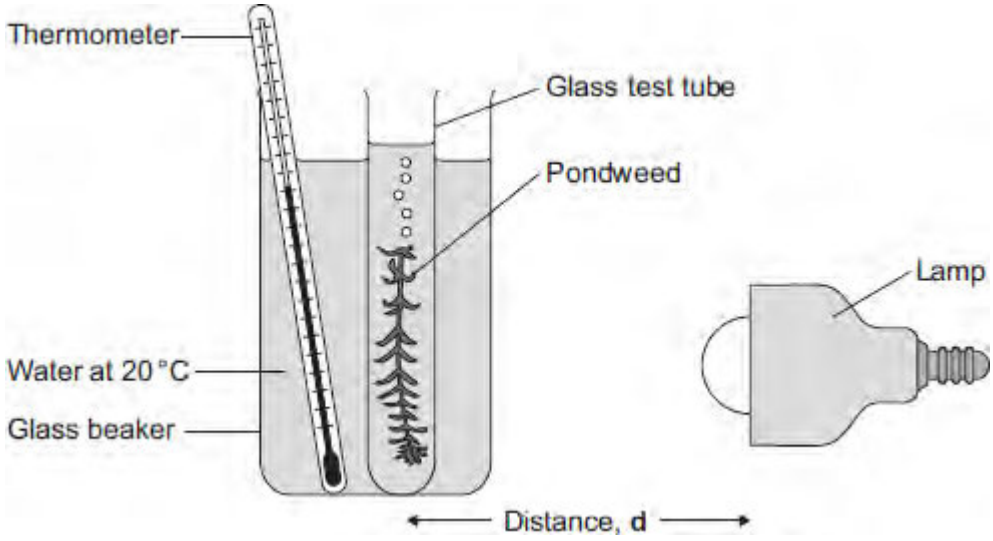
Q2.(a) Complete the equation for photosynthesis. Draw a ring around each correct answer.

Carbon dioxide	+	hydrogen nitrogen water	light energy →	alcohol glucose methane	+ oxygen

(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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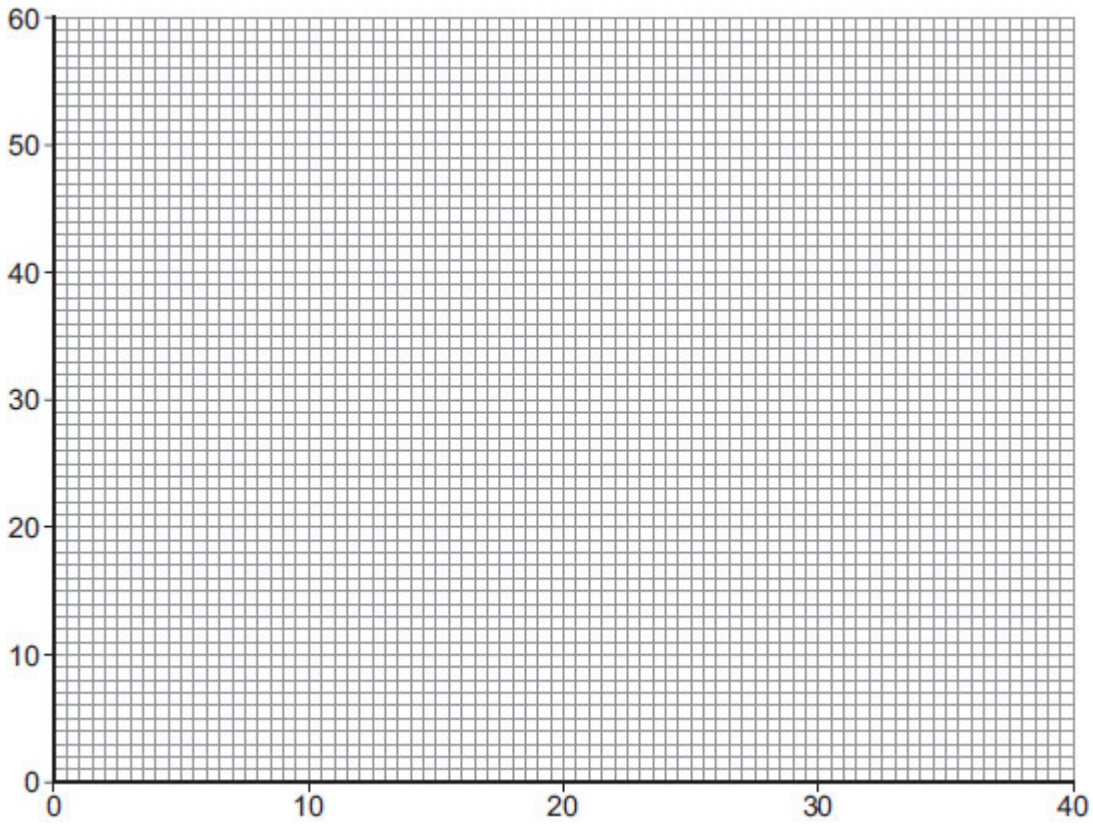
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Mean number of bubbles at 40 cm = ...

(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.



Distance **d** in cm

(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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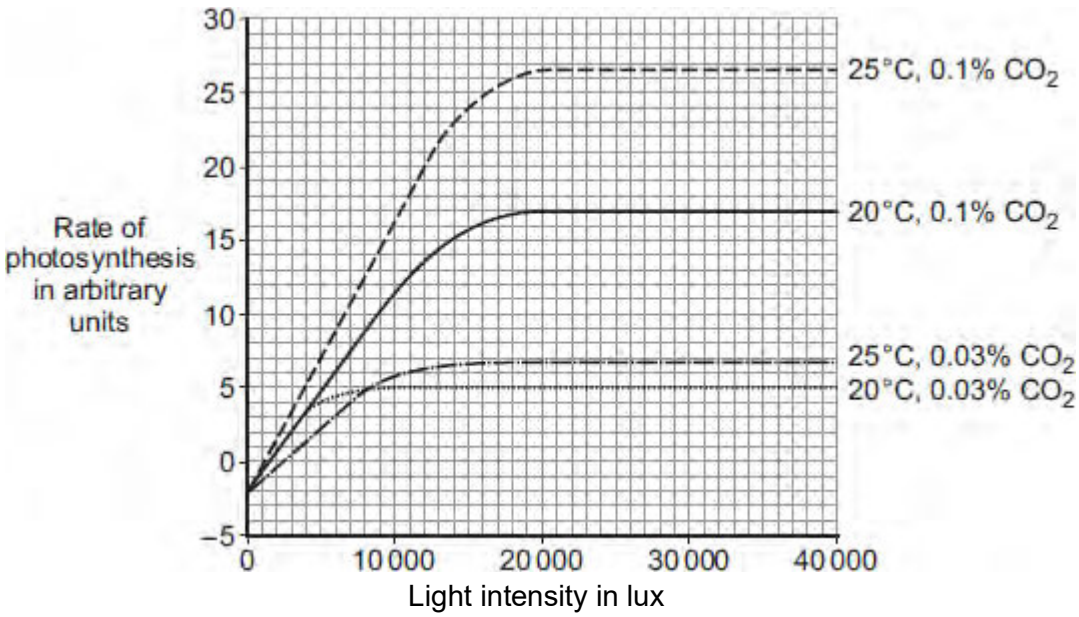
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(2)

(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% CO_2
- 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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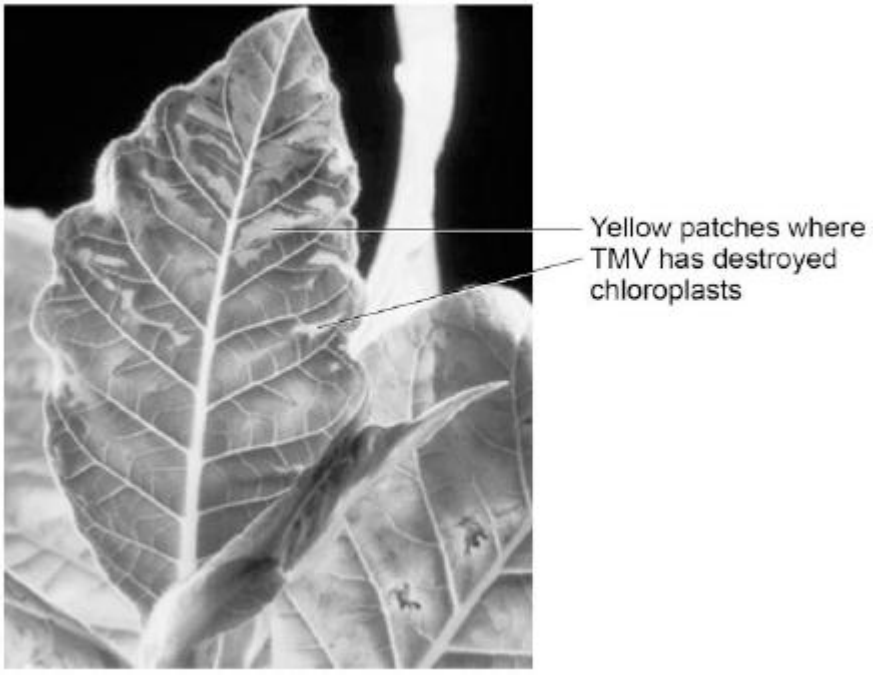
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(4)
(Total 17 marks)

Q3. Tobacco mosaic virus (TMV) is a disease affecting plants.

The diagram below shows a leaf infected with TMV.



© Nigel Cattlin/Visuals Unlimited/Getty Images

(a) All tools should be washed in disinfectant after using them on plants infected with TMV.

Suggest why.

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(1)

(b) Scientists produced a single plant that contained a TMV-resistant gene.

Suggest how scientists can use this plant to produce **many** plants with the TMV-resistant gene.

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(1)

(c) Some plants produce fruits which contain glucose.

Describe how you would test for the presence of glucose in fruit.

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(2)

(d) TMV can cause plants to produce less chlorophyll.

This causes leaf discoloration.

Explain why plants with TMV have stunted growth.

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(4)
(Total 8 marks)

Q4. Photosynthesis needs light.

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

$$6CO_2 + \text{.....} \xrightarrow{\text{light}} \text{.....} + 6O_2$$

(2)

(b) A green chemical indicator shows changes in the concentration of carbon dioxide (CO_2) in a solution.

The indicator solution is **green** when the concentration of CO_2 is normal.

The indicator solution turns **yellow** when the concentration of CO_2 is high.

The indicator solution turns **blue** when the concentration of CO_2 is very low or when there is no CO_2.

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)

Q5.A gardener wants to add compost to the soil to increase his yield of strawberries.

The gardener wants to make his own compost.

(a) An airtight compost heap causes anaerobic decay.

Explain why the gardener might be against producing compost using this method.

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(2)

(b) The gardener finds this research on the Internet:

'A carbon to nitrogen ratio of 25:1 will produce fertile compost.'

Look at the table below.

Type of material to compost	Mass of carbon in sample in g	Mass of nitrogen in sample in g	Carbon:nitrogen ratio
Chicken manure	8.75	1.25	7:1
Horse manure	10.00	0.50	20:1
Peat moss	9.80	0.20	**X**

Determine the ratio **X** in the table above.

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Ratio .....

(1)

(c) Which type of material in the table above would be **best** for the gardener to use to make his compost?

Justify your answer.

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(1)

(d) Some of the leaves from the gardener's strawberry plant die.

The dead leaves fall off the strawberry plant onto the ground.

The carbon in the dead leaves is recycled through the carbon cycle.

Explain how the carbon is recycled into the growth of new leaves.

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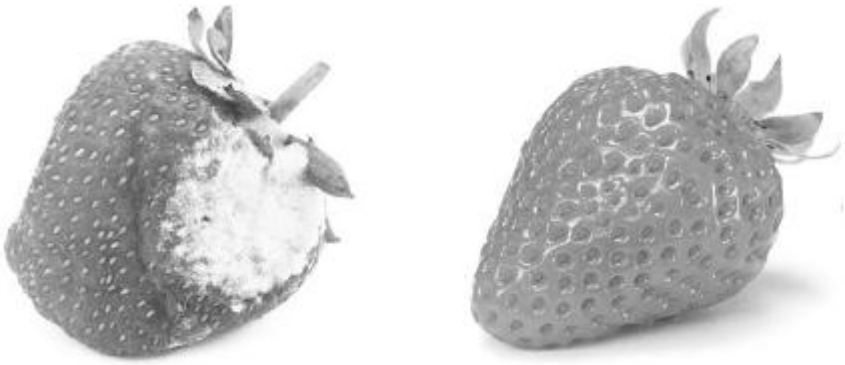
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(6)

(e) The diagram below shows two strawberries.

- Both strawberries were picked from the same strawberry plant.
- Both strawberries were picked 3 days ago.
- The strawberries were stored in different conditions.

Strawberry A **Strawberry B**



A © sarahdoow/iStock/Thinkstock, B © Mariusz Vlack/iStock/Thinkstock

Give **three** possible reasons that may have caused strawberry **A** to decay.

1 .....

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2 .....

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3 .....

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(3)
(Total 13 marks)