Q1.

Metabolism is the sum of all the chemical reactions in the cells of the body.

One metabolic reaction is the formation of lipids.

(a) Give **one** other metabolic reaction in cells.

____

____

(1)

Table 1 shows the mean metabolic rate of humans of different ages.

Table 1

Age in years	**Mean metabolic rate in kJ/m²/hour**	
	Males	**Females**
5	53	53
15	45	42
25	39	35
35	37	35
45	36	35

(b) What **two** conclusions can be made from the data in **Table 1**?

Tick **two** boxes.

As age increases, mean metabolic rate of males and females increases.	☐
Males have a higher metabolic rate than females after five years of age.	☐
The mean metabolic rate of females decreases faster than males up to 25 years of age.	☐
The mean metabolic rate of males and females decreases more quickly after the age of 35.	☐
There is no relationship between age and mean metabolic rate.	☐

(2)

(c) Calculate the percentage decrease in the mean metabolic rate of males between 5 years and 45 years of age.

Use the equation:

$$\text{percentage decrease} = \frac{\text{decrease in metabolic rate}}{\text{original metabolic rate}} \times 100$$

Give your answer to 3 significant figures.

____

____

____

____

Percentage decrease = ____________________

(3)

Regular exercise can increase metabolic rate.

Two people did five minutes of gentle exercise from rest.

Table 2 shows the effect of the exercise on their heart rates.

Table 2

Time in minutes	**Heart rate in beats per minute**	
	Person R	**Person S**
0 (at rest)	60	78
1	76	100
2	85	110
3	91	119
4	99	129
5	99	132

(d) Describe **two** differences in the response of person **R** and person **S** to the exercise.

Use information from **Table 2**.

1. ____

____

2. ____

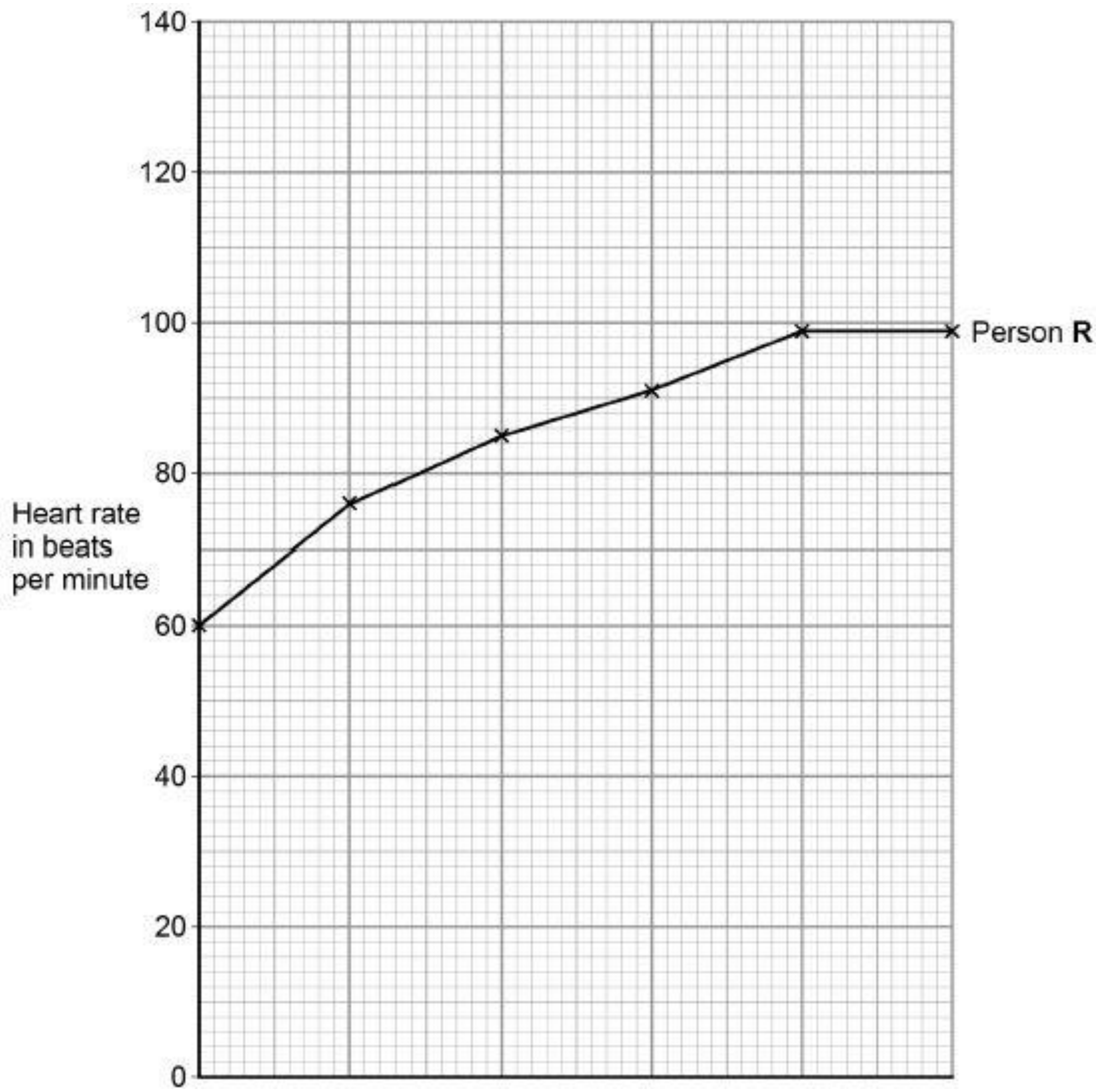
____

(2)

(e) Complete the line graph below for person **S**.

You should:

- add the scale to the x axis
- label the x axis.



(4)

(f) After five minutes of exercise, the heart rate of person **S** was 132 beats per minute. When person **S** rested, his heart rate decreased steadily at a rate of 12 beats every minute.

Calculate how much time it would take the heart rate of person **S** to return to its resting rate.

____

____

____

Time = ____________________ minutes

(2)

(Total 14 marks)

Q2.

Glucose is broken down in respiration.

(a) What is the chemical formula for glucose?

Tick **one** box.

$C_6H_6O_6$ ☐

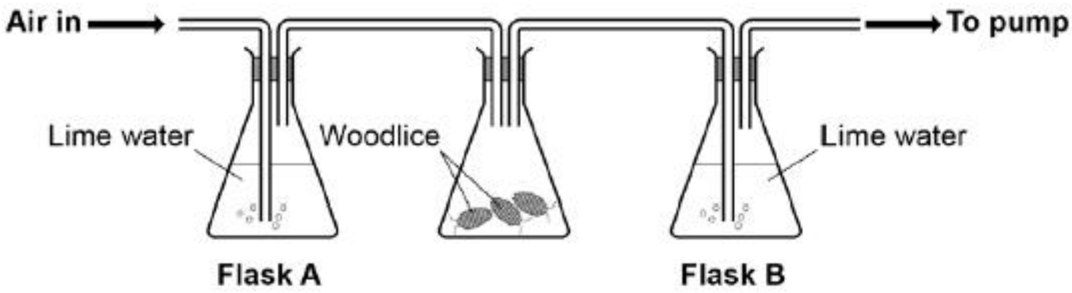
$C_3H_6O_3$ ☐

$C_6H_{12}O_6$ ☐

$C_6H_{10}O_6$ ☐

(1)

The diagram shows the apparatus a student used to investigate aerobic respiration.



Limewater goes cloudy when carbon dioxide is added to it.

(b) After 10 minutes the limewater in flask **B** was cloudy, but the limewater in flask **A** remained colourless.

Explain why.

___

___

___

___

(2)

(c) Flask **A** acts as a control in this investigation.

What is the purpose of a control?

___

___ **(1)**

(d) The student repeated the investigation with no woodlice.

Describe the appearance of the limewater in flask **A** and flask **B** after 10 minutes.

Flask **A** ____

____

Flask **B** ____

____

(2)

Anaerobic respiration is another form of respiration in living organisms.

(e) What is produced during anaerobic respiration in humans?

Tick **one** box.

Carbon dioxide	☐
Carbon dioxide and lactic acid	☐
Lactic acid	☐
Oxygen and water	☐

(1)

(f) Complete the equation for anaerobic respiration in yeast.

glucose → carbon dioxide + ______________________

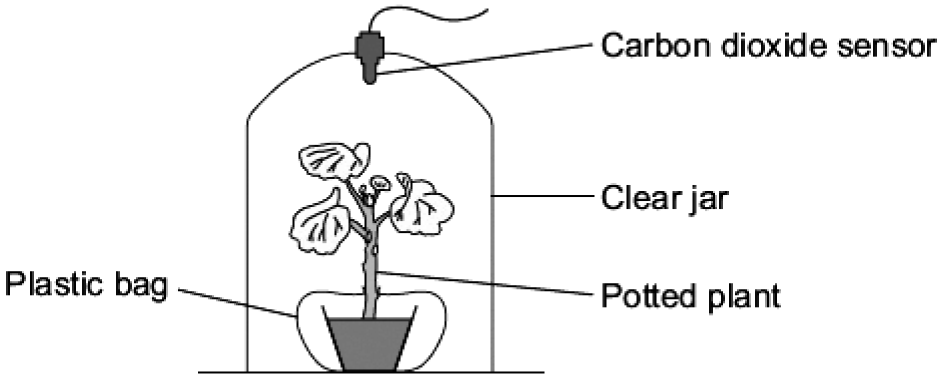
(1)

(Total 8 marks)

Q3.

A student measured the concentration of carbon dioxide in the air around a potted plant on two different days.

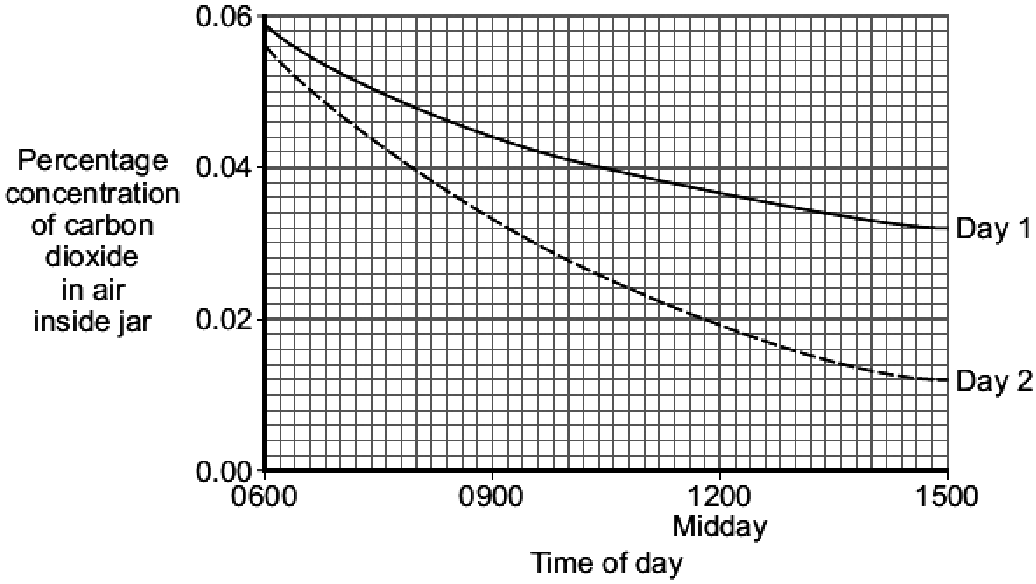
The diagram shows the student's apparatus.



There was a plastic bag round the plant pot to stop microorganisms in the soil affecting the concentration of gases in the air inside the jar.

The apparatus was put near a window.

The graph shows the results.



(a) **Day 1** was cloudier than **Day 2.**

What evidence from the graph shows that **Day 1** was cloudier?

Explain your answer.

___

___

___

___

(2)

(b) A potted plant sometimes develops yellow leaves.

The development of yellow leaves could be due to the lack of a mineral ion.

Suggest the mineral ion that could be lacking.

____

(1)
(Total 3 marks)

Q4.

Anaerobic respiration happens in muscle cells and yeast cells.

The equation describes anaerobic respiration in muscle cells.

glucose $\longrightarrow$ **lactic acid**

(a) How can you tell from the equation that this process is anaerobic?

____

____

(1)

(b) Exercise **cannot** be sustained when anaerobic respiration takes place in muscle cells.

Explain why.

____

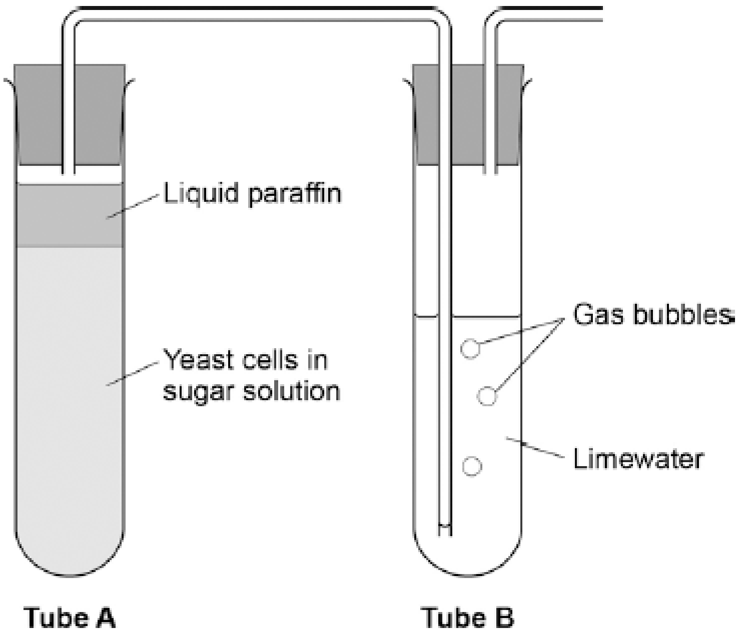
____

____

____

(2)

(c) The diagram below shows an experiment to investigate **anaerobic** respiration in yeast cells.



What gas will bubble into Tube **B**?

Tick **one** box.

Carbon dioxide ☐

Nitrogen ☐

Oxygen ☐

Water vapour ☐

(1)

(d) Describe how you could use tube **B** to measure the rate of the reaction in tube **A**.

___

___

___

___

(2)

(e) Anaerobic respiration in yeast is also called fermentation.

Fermentation produces ethanol.

Give **one** use of fermentation in the food industry.

____

(1)
(Total 7 marks)

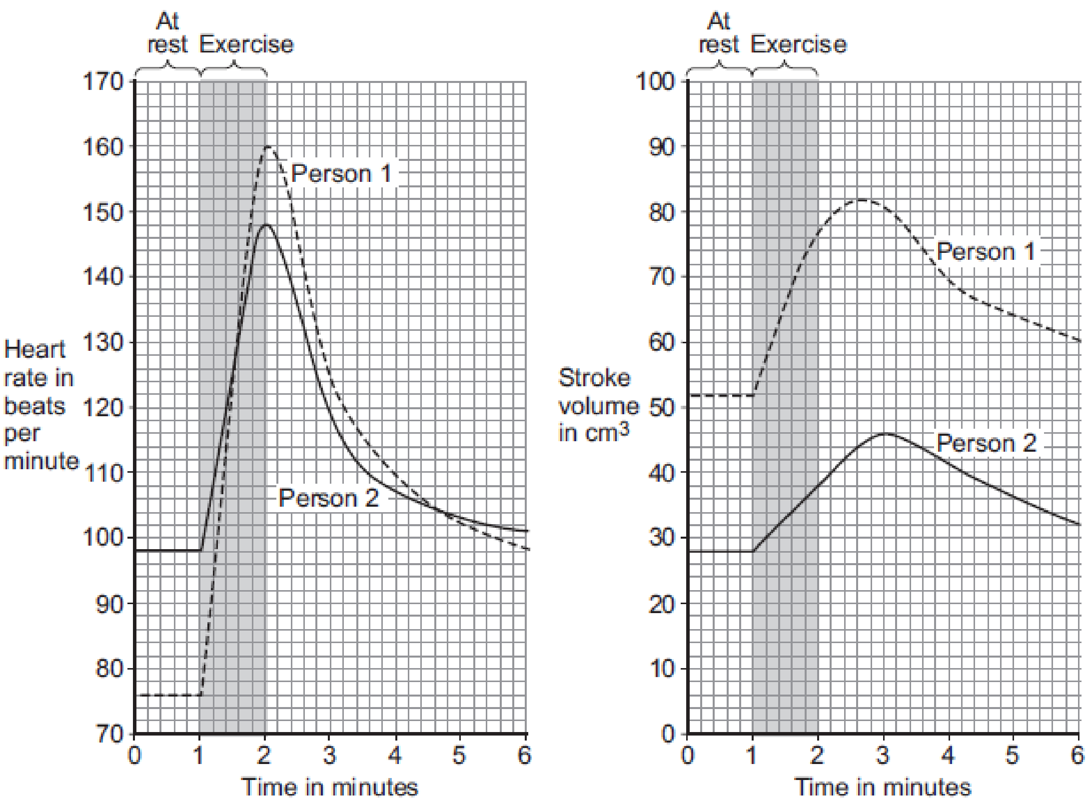
Q5.

During exercise, the heart beats faster and with greater force.

The 'heart rate' is the number of times the heart beats each minute.The volume of blood that travels out of the heart each time the heart beats is called the 'stroke volume'.

In an investigation, **Person 1** and **Person 2** ran as fast as they could for 1 minute. Scientists measured the heart rates and stroke volumes of **Person 1** and **Person 2** at rest, during the exercise and after the exercise.

The graph below shows the scientists' results.



(a) The 'cardiac output' is the volume of blood sent from the heart to the muscles each minute.

Cardiac output = Heart rate × Stroke volume

At the end of the exercise, **Person 1**'s cardiac output = 160 × 77 = 12 320 cm^3 per minute.

Use information from the figure above to complete the following calculation of **Person 2**'s cardiac output at the end of the exercise.

At the end of the exercise:

Person 2's heart rate = _______________ beats per minute

Person 2's stroke volume = _______________ cm^3

Person 2's cardiac output = _______________ cm^3 per minute

(3)

(b) **Person 2** had a much lower cardiac output than **Person 1.**

(i) Use information from the figure above to suggest the **main** reason for the lower cardiac output of **Person 2**.

____

____

(1)

(ii) **Person 1** was able to run much faster than **Person 2**.

Use information from the figure above and your own knowledge to explain why.

____

____

____

____

____

____

____

____

____

____

(5)

(Total 9 marks)

Q6.

This question is about photosynthesis.

(a) Plants make glucose during photosynthesis. Some of the glucose is changed into insoluble starch.

What happens to this starch?

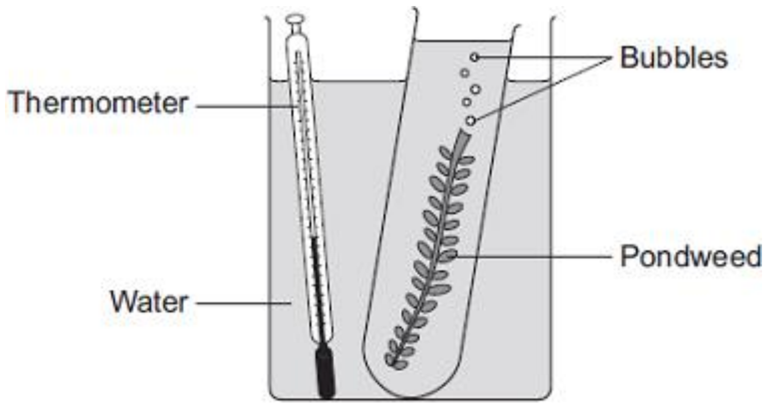
Tick (✓) **one** box.

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

(1)

(b) A student investigated the effect of temperature on the rate of photosynthesis in pondweed.

The diagram shows the way the experiment was set up.



(i) The student needed to control some variables to make the investigation fair.

State **two** variables the student needed to control in this investigation.

1. ____

2. ____

(2)

(ii) The bubbles of gas are only produced while photosynthesis is taking place.

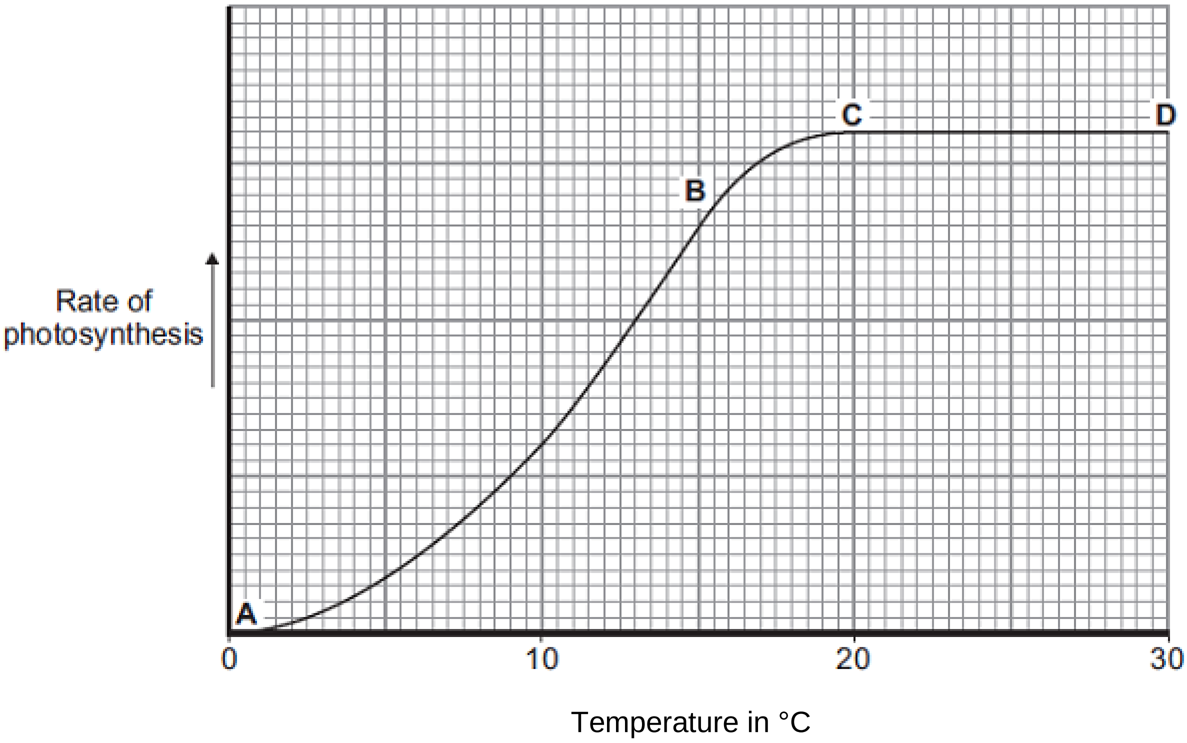
What **two** measurements would the student make to calculate the rate of photosynthesis?

1. ______________________________

2. ______________________________

(2)

(c) The graph shows the effect of temperature on the rate of photosynthesis in the pondweed.



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

____

(1)

(ii) Suggest which factor, carbon dioxide, oxygen or water, might limit the rate of photosynthesis between the points labelled **C** and **D** on the graph.

____

(1)

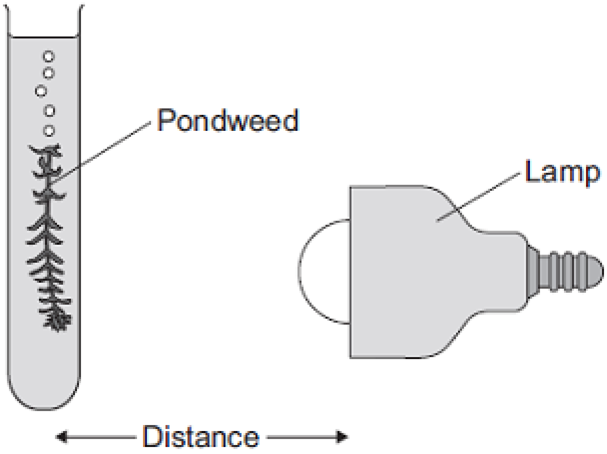
(Total 7 marks)

Q7.

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

They used the apparatus shown in **Diagram 1**.

Diagram 1



The students:

- placed the lamp 10 cm from the pondweed
- counted the number of bubbles of gas released from the pondweed in 1 minute
- repeated this for different distances between the lamp and the pondweed.

(a) The lamp gives out heat as well as light.

What could the students do to make sure that heat from the lamp did **not** affect the rate of photosynthesis?

____

____

(1)

(b) The table shows the students' results.

Distance in cm	**Number of bubbles per minute**
10	84
15	84
20	76
40	52
50	26

(i) At distances between 15 cm and 50 cm, light was a limiting factor for photosynthesis.

What evidence is there for this in the table?

____

____

(1)

(ii) Give **one** factor that could have limited the rate of photosynthesis when the distance was between 10 cm and 15 cm.

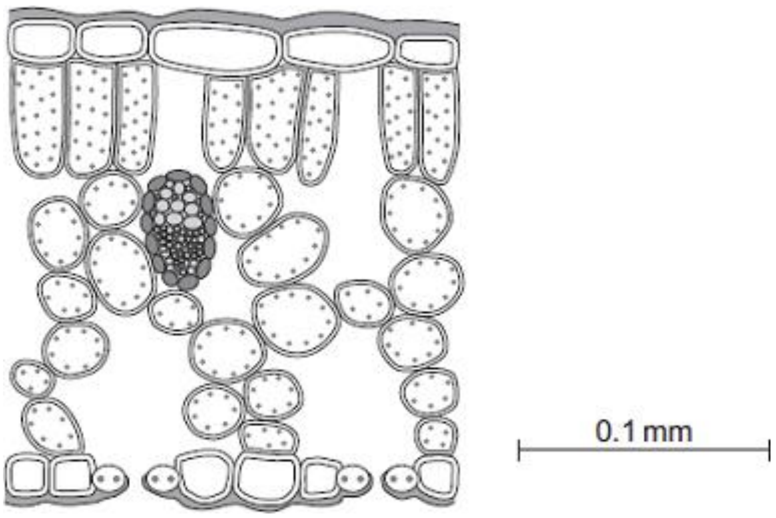
____

(1)

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

Diagram 2 shows a section through a plant leaf.

Diagram 2



Describe the structure of the leaf and the functions of the tissues in the leaf.

You should use the names of the tissues in your answer.

____

____

____

____

____

____

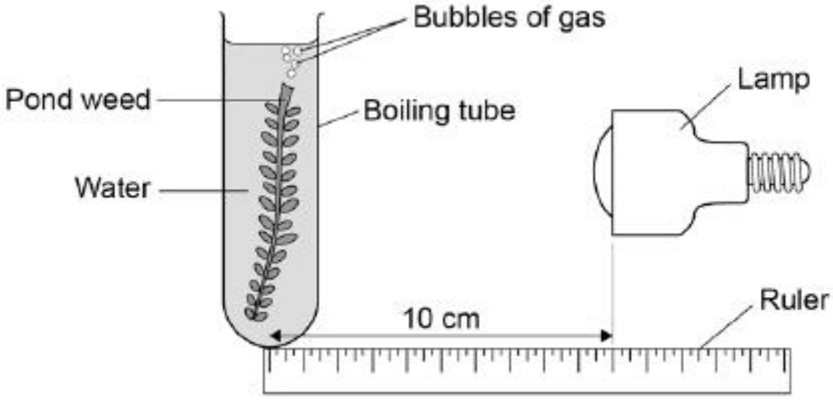
____

(6)
(Total 9 marks)

Q8.

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

The diagram shows the apparatus the student used.



This is the method used.

1. Set up the apparatus as shown in the diagram above.
2. Place the lamp 10 cm from the pondweed.
3. Turn the lamp on and count the number of bubbles produced in one minute.
4. Repeat with the lamp at different distances from the pondweed.

(a) Complete the hypothesis for the student's investigation.

'As light intensity increases, ____

____ .'

(1)

(b) What was the independent variable in this investigation?

Tick **one** box.

- Light intensity ☐
- Number of bubbles produced ☐
- Temperature ☐
- Time ☐

(1)

(c) The teacher suggests putting the boiling tube into a beaker of water during the investigation.

Suggest why this would make the results more valid.

____

____

(1)

Table 1 shows the student's results.

Table 1

Distance of lamp from pondweed in cm	**Number of bubbles produced per minute**			
	Trial 1	**Trial 2**	**Trial 3**	**Mean**
10	67	66	69	67
20	61	64	62	62.3
30	53	51	52	**X**
40	30	32	31	31
50	13	15	15	14

(d) Calculate value **X** in **Table 1**.

____

____

X = ____________________ bubbles per minute

(1)

(e) State **one** error the student has made when completing the results at 20 cm.

____

____

(1)

(f) What evidence in **Table 1** shows that the data is repeatable?

Tick **one** box.

- The number of bubbles decreases as distance decreases. ☐
- The numbers of bubbles at each distance are similar. ☐
- The student calculated a mean for each distance. ☐
- The student did the experiment three times. ☐

(1)

Another student investigated the effect of the colour of light on the rate of photosynthesis.

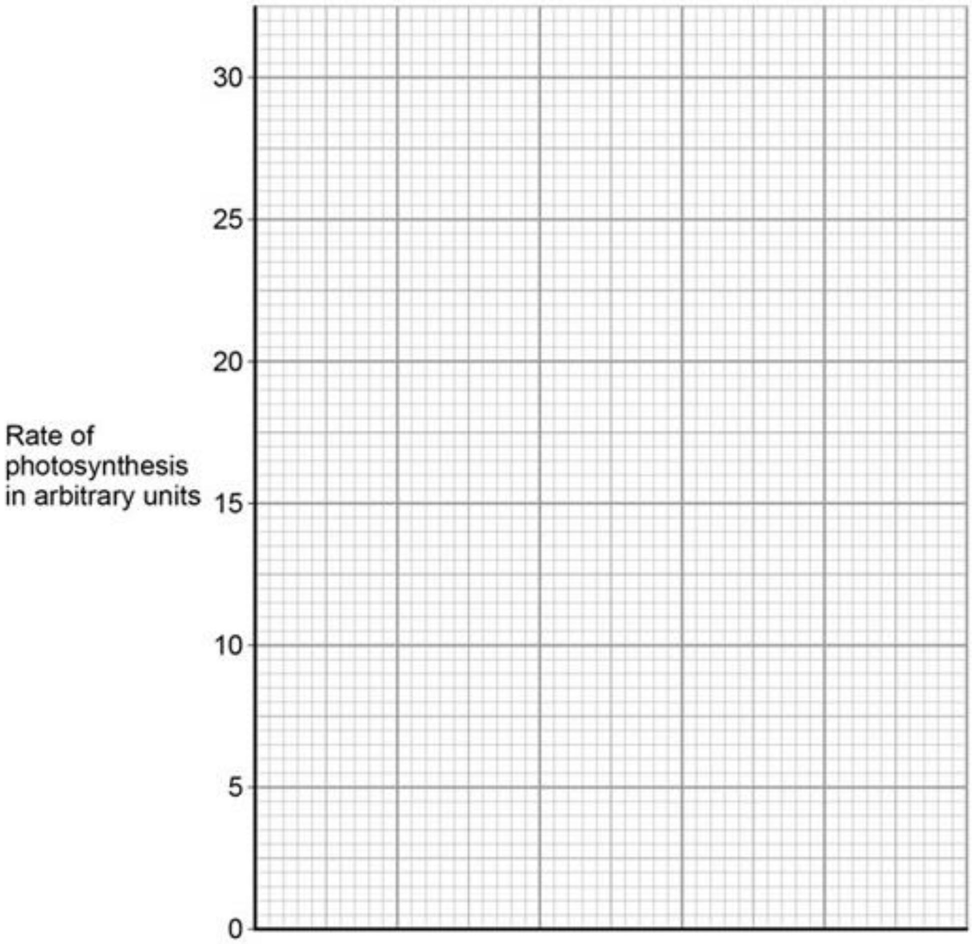
The results are shown in **Table 2**.

Table 2

Colour of light	**Rate of photosynthesis in arbitrary units**
Blue	24
Green	4
Red	17
Yellow	8

(g) Plot the data from **Table 2** on the graph.

You should label the x-axis.



(3)

(h) Give **two** conclusions from the graph above.

1. ____

____

2. ____

____

(2)

(i) The glucose produced in photosynthesis can be converted into amino acids to make new proteins for the plant.

Complete the sentences.

The glucose produced in photosynthesis can also be used in other ways.

Glucose can be used in respiration to release __________________ .

Glucose can be converted to cellulose to strengthen the __________________ .

Glucose can be stored as __________________ .

(3)
(Total 14 marks)