ST MARY'S SCIENCE DEPARTMENT:

BIOLOGY

H

GCSE BIOLOGY
HOMEWORK BOOK
TOPIC 5: PLANTS
STUDENT BOOK

YOU MUST ANSWER ALL THREE SECTIONS IN EACH PART OF THE HOMEWORK TASKS

NAME	
CLASS	
TEACHER	
FORM	

TASK	MARK	GRADE
1		
2		
3		
4		
OVERALL		

GCSE BIOLOGY

YEAR 10

TOPIC 2

HOMEWORK SCHEDULE

Please use the following table to ensure each homework task is completed and submitted on time.

Carrying out these homework tasks can only increase your ability to gain a high grade in the GCSE examinations.

Failure to hand in work on time will lead to sanctions to complete this work.

Task	Submission Date	Completed?	On Time?
Task 1 Plant Tissues			
Task 2 Plant Organ Systems			
Task 3 Photosynthesis			
Task 4 Photosynthesis Investigation			

SCIENCE DEPARTMENT MARKING CODE

ID = Insufficient detail in answer
W = Wrong understanding of science
IR = Irrelevant information given.
V = This is too vague to get a mark.
AQ = Answer the question asked
R = Read the question/information
M = Maths mistake
BOD = Benefit of the doubt given.
E = Explain the answer further please.
U = Wrong units used.
SF = Wrong significant figures used.
SP = Wrong spelling of a technical term
SR = Same reason given more than once.
A circle means this lost you marks
An underline means this gained you marks

PLEASE READ

This homework booklet has made with custom selected examination questions and activities to assess your understanding in the concepts covered in class. This will increase your familiarity with the style of examination questions.

Carrying out these questions can only increase your ability to gain a high grade in the GCSE examination.

Thank you for your hard work in completing this book, and good luck.

Mr. Turnbull

TASK 1: PLANT TISSUES

SPEC CHECK

Content	Achieved?
Students should be able to explain how the structures of plant tissues are related to their functions. Plant tissues include: • Epidermal tissues • Palisade mesophyll • Spongy mesophyll • Xylem and phloem • Meristem tissue found at the growing tips of shoots and roots. The leaf is a plant organ. Knowledge limited to epidermis, palisade and spongy mesophyll, xylem and phloem, and guard cells surrounding stomata.	

Target Setting
In this assessed piece of work, what target should I look to achieve in completing this task? Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

What Topics Do I Know Well?

What Topics Do I Need to Revise?

SECTION A

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

1. A student compared the number of stomata on the upper and lower surfaces of a leaf.

She completed a leaf peel as shown in **Figure 5**.

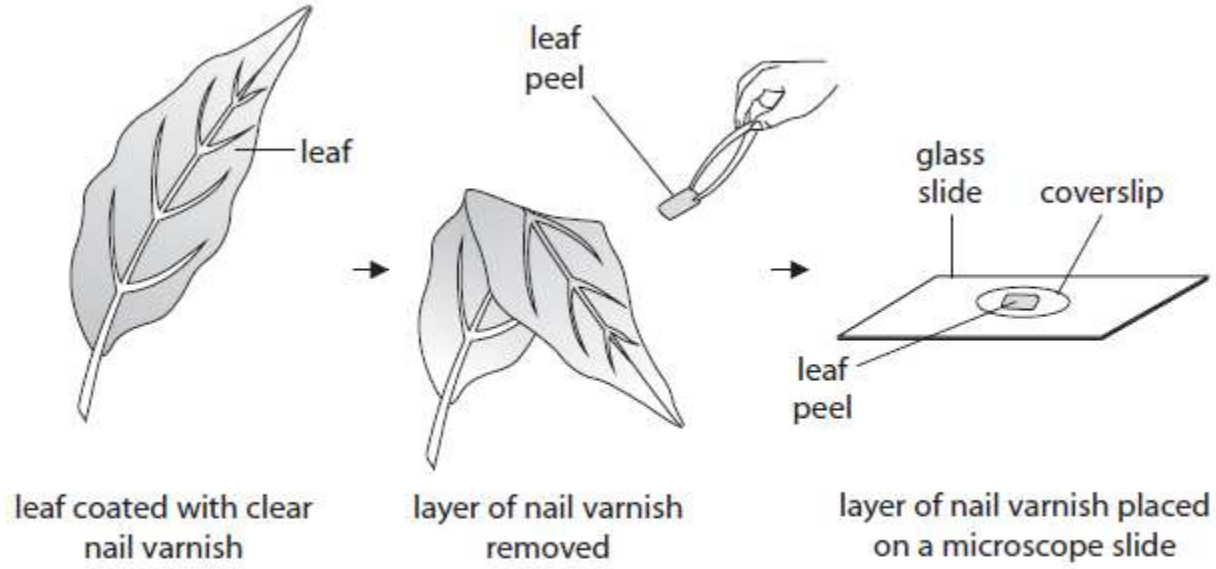

Figure 5

The layer of nail varnish shows an impression of the cells on the surface of the leaf.

1.1 State why a coverslip is placed on top of the leaf peel.

[1 Mark]

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1.2 Explain why the leaf peel rather than the whole leaf was viewed with a microscope.

[2 Marks]

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The student drew a biological diagram of the leaf peel taken from the underside of the leaf.

Figure 6 shows this diagram.

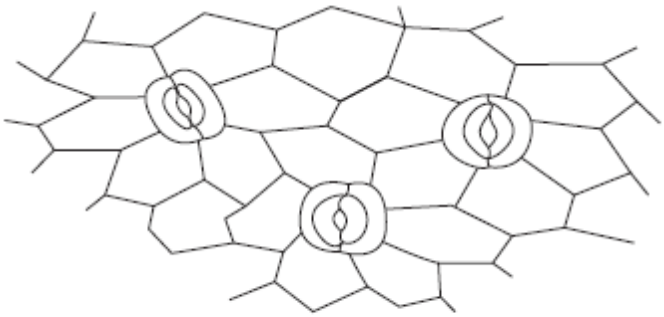

Figure 6

1.3 State the number of stomata visible on **Figure 6.**

[1 Mark]

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1.4 The student observed that the stomata were open.

Describe how stomata open.

[3 Marks]

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1.5 The leaf peel from the upper surface of this leaf showed no stomata.

Explain why it is an advantage to the plant to have this distribution of stomata in the upper and lower surfaces of the leaf.

[2 Marks]

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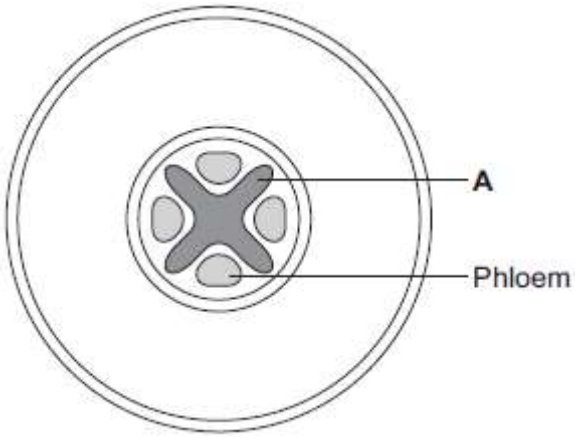
SECTION B

This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

1. The diagram below shows a cross-section of a plant root. The transport tissues are labelled.



1.1 What is tissue **A**?

Draw a ring around the correct answer.

[1 Mark]

cuticle **epidermis** **xylem**

1.2 Name **two** substances transported by tissue **A**.

[2 Marks]

1. _____

2. _____

Phloem is involved in a process called translocation.

1.3 What is translocation?

[1 Mark]

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.....

1.4 Explain why translocation is important to plants.

[2 Marks]

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Plants must use active transport to move some substances from the soil into root hair cells.

1.5 Active transport needs energy.

Which part of the cell releases most of this energy?

Tick **one** box.

[1 Mark]

mitochondria	☐
nucleus	☐
ribosome	☐

1.6 Explain why active transport is necessary in root hair cells.

[2 Marks]

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SECTION C

This is a challenge question to extend your understanding.

You should aim to spend **10 minutes** answering this section.

1. Figure 4 shows apparatus you could use to mount a piece of leaf epidermis for examination under a microscope.

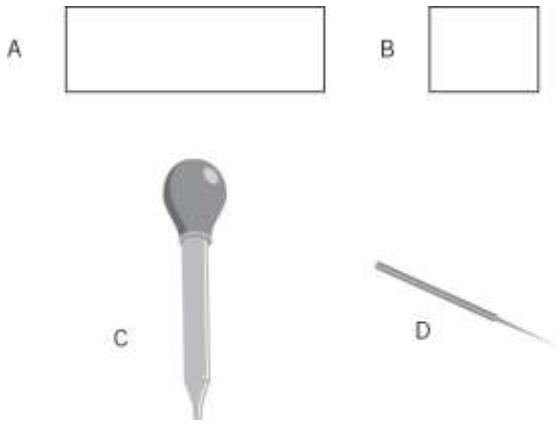

Figure 4

1.1 Describe how you would use **A**, **B**, **C** and **D** to mount a piece of leaf epidermis for examination under a microscope.

[3 Marks]

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1.2 A student used a grid on a microscope to estimate the number of stomata in some leaf epidermis.

Figure 5 shows four of the grid squares the student observed.

Each grid has an area of 0.0001 mm^2.

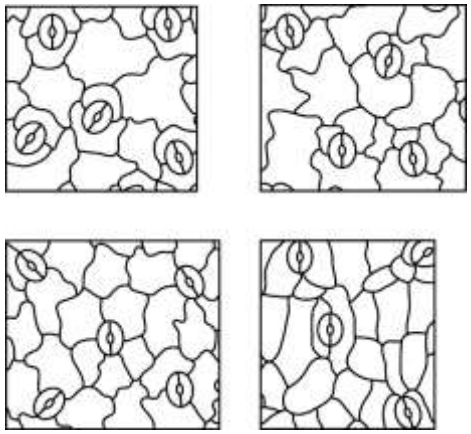

Figure 5

Calculate the mean number of stomata per grid square.

[2 Marks]

.....

.....

Mean Number of Stomata per Grid Square .....

1.3 Calculate the mean number of stomata per 1 mm^2 of leaf epidermis.

[2 Marks]

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.....

Mean Number of Stomata per 1 mm^2 = ...

1.4 Each side of a grid square has a length of approximately 0.003 mm.

Use this information to estimate the length of a guard cell.

[2 Marks]

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.....

Estimated Length of Guard Cell = ... mm

1.5 A group of students looked at stomata on four different species of plant, **W**, **X, Y** and **Z**.

The students estimated the number of stomata per cm^2 on the upper and lower surfaces of the leaves of the four species.

The results are shown in the **Table 1**.

Table 1

Plant species	**Estimated number of stomata per cm^2 of leaf surface**	
	Upper surface of leaf	**Lower surface of leaf**
W	4000	28 000
X	0	800
Y	8500	15 000
Z	8000	26 000

Which plant species, **W**, **X**, **Y** or **Z**, probably lives in a dry region?

Explain why you have chosen this species.

[3 Marks]

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1.6 All four species have more stomata on the lower surface of their leaves than on the upper surface.

Suggest how this feature could improve the chances of the survival for the plants.

[2 Marks]

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FEEDBACK SHEET

Overall Mark:	**/32**	**GRADE ACHIEVED:**	
		9 ☐	**5** ☐
		8 ☐	**4** ☐
		7 ☐	**3** ☐
		6 ☐	**U** ☐
Section A: Mark	/9		
Section B: Mark	/9		
Section C: Mark	/14		

Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding

Strengths:	☐ Basic Knowledge of Concepts ☐ Quality of Written Communication ☐ Working Scientifically ☐ Answering Examination Questions ☐ Analytical Skills **Others** (Topic Specific)	☐ Applications of Concepts ☐ Mathematical Skills ☐ Experimental Technique ☐ Previous Topics ☐ Problem Solving
Areas to Improve:	☐ Basic Knowledge of Concepts ☐ Quality of Written Communication ☐ Working Scientifically ☐ Answering Examination Questions ☐ Analytical Skills **Others** (Topic Specific)	☐ Applications of Concepts ☐ Mathematical Skills ☐ Experimental Technique ☐ Previous Topics ☐ Problem Solving

Progress:	Unsatisfactory	Satisfactory	Good	Outstanding
Working:	Below	In line with	Above	**(your target)**
Effort:	Poor	Inconsistent	Good	Excellent

To improve further you need to:

☐ Carry out **independent** revision.	☐ Revise the equations.
☐ Complete outstanding work.	☐ Check the units on answers.
☐ Make corrections as indicated by the teacher.	☐ Check the correct amount of sig figs on answers.
☐ Attend intervention for this topic	☐ Check to convert values correctly.
☐ Include more information in responses.	☐ Show your full working out.
☐ Include more key words in responses.	☐ Check your calculations.
☐ Attend departmental revision sessions.	☐ Revise the science investigative skills.
☐ Read the questions carefully.	☐ Revise the key concepts of the topics.
☐ Explain your answers in more detail.	☐ Thoroughly check your work for mistakes.
☐ Carry out revision on Seneca Learning.	Other:

Student response

TASK 2: PLANT ORGAN SYSTEMS

SPEC CHECK

Content	Achieved?
Students should be able to explain how the structure of root hair cells, xylem and phloem are adapted to their functions. Students should be able to explain the effect of changing temperature, humidity, air movement and light intensity on the rate of transpiration.	
Students should be able to understand and use simple compound measures such as the rate of transpiration.	
Students should be able to: • Translate information between graphical and numerical form • Plot and draw appropriate graphs, selecting appropriate scales for axes • Extract and interpret information from graphs, charts and tables.	
The roots, stem and leaves form a plant organ system for transport of substances around the plant. Students should be able to describe the process of transpiration and translocation, including the structure and function of the stomata. Root hair cells are adapted for the efficient uptake of water by osmosis, and mineral ions by active transport. Xylem tissue transports water and mineral ions from the roots to the stems and leaves. It is composed of hollow tubes strengthened by lignin adapted for the transport of water in the transpiration stream. The role of stomata and guard cells are to control gas exchange and water loss. Phloem tissue transports dissolved sugars from the leaves to the rest of the plant for immediate use or storage. The movement of food molecules through phloem tissue is called translocation. Phloem is composed of tubes of elongated cells. Cell sap can move from one phloem cell to the next through pores in the end walls.	

Target Setting

In this assessed piece of work, what target should I look to achieve in completing this task? Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

What Topics Do I Know Well?	What Topics Do I Need to Revise?

SECTION A

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

1.1 Water enters a plant through root hair cells.

Root hair cells have

Tick **one** box only.

[1 Mark]

- ☐ **A** a small surface area and thin cell walls
- ☐ **B** a small surface area and thick cell walls
- ☐ **C** a large surface area and thin cell walls
- ☐ **D** a large surface area and thick cell walls

1.2 Explain how water in the root is transported to the leaves of the plant.

[2 Marks]

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1.3 How is sucrose transported from the leaves to other parts of the plant?

Tick **one** box only.

[1 Mark]

- ☐ **A** by osmosis through the phloem
- ☐ **B** by osmosis through the xylem
- ☐ **C** by translocation through the phloem
- ☐ **D** by translocation through the xylem

Figure 7 shows the average size of stomata in a leaf during one day.

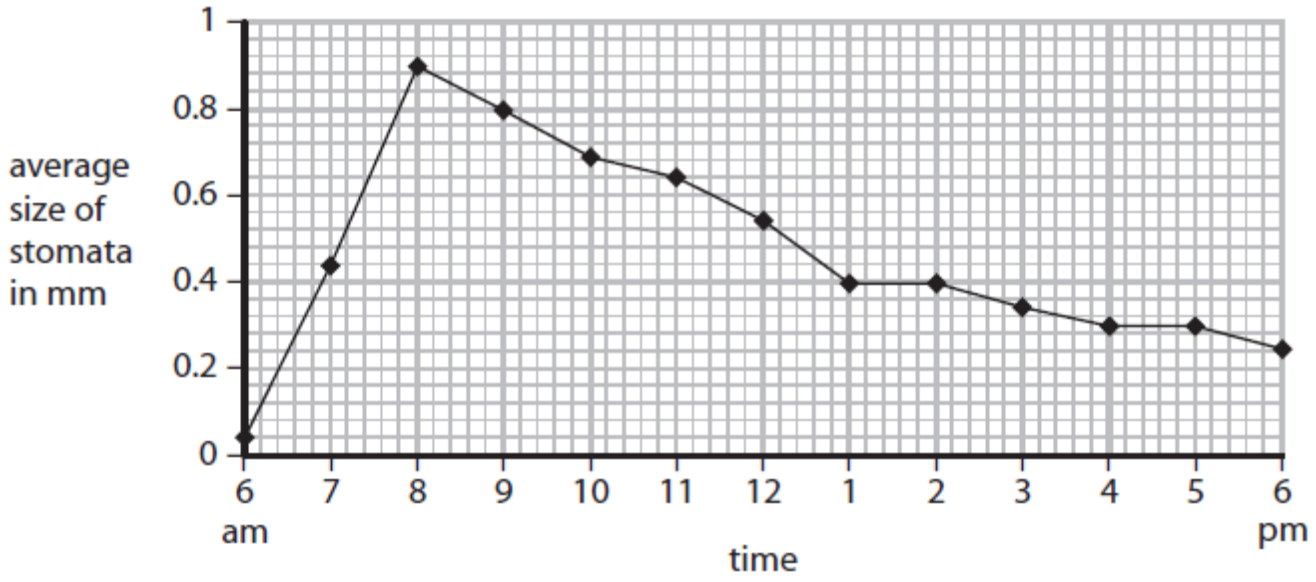

Figure 7

1.4 Name the cells that change the size of stomata.

[1 Mark]

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1.5 Describe the trend shown in **Figure 7.**

[2 Marks]

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1.6 The temperature increased from 8 am to 1 pm.

Explain why this affected the size of the stomata.

[2 Marks]

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SECTION B

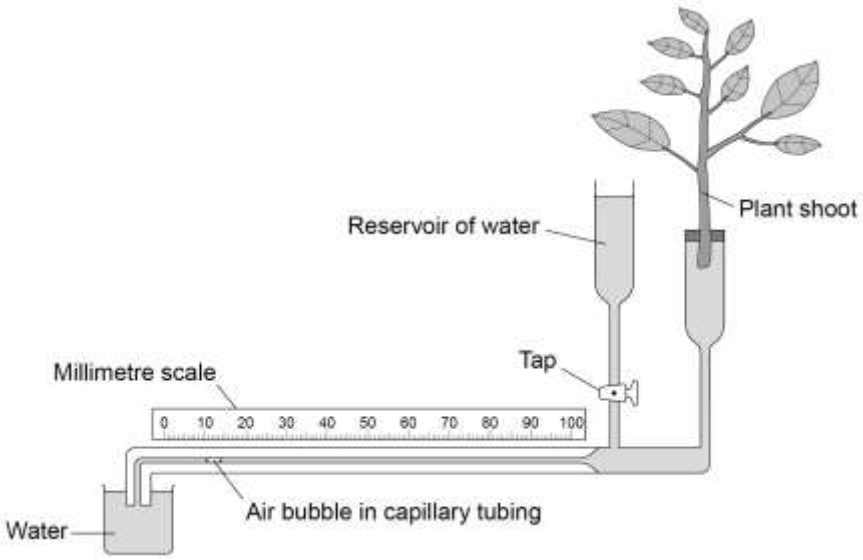
This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

1. A student used a potometer to investigate the rate of water uptake in a plant shoot.

Figure 3 shows a potometer.

Figure 3



As the shoot takes in water the air bubble moves.

The rate of water uptake is the distance the air bubble moves in a given time.

This is the method used.

1. Place the potometer in moist air at 25 °C

2. Position the air bubble at 0 mm in the capillary tube.

3. Record the position of the air bubble in the capillary tube every minute for 5 minutes.

4. Repeat steps **2** and **3** with the potometer in different conditions.

Table 3 shows the conditions used.

Table 3

Investigation	Conditions
A	Moist air at 25 °C
B	Dry air at 15 °C
C	Dry air at 25 °C

1.1 After investigation **A** the air bubble had moved part way along the capillary tube.

Suggest how the student moved the air bubble back to 0 mm for the start of investigation **B**.

[1 mark]

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1.2 Capillary tubing is very narrow.

Explain why narrow tubing was used.

[2 marks]

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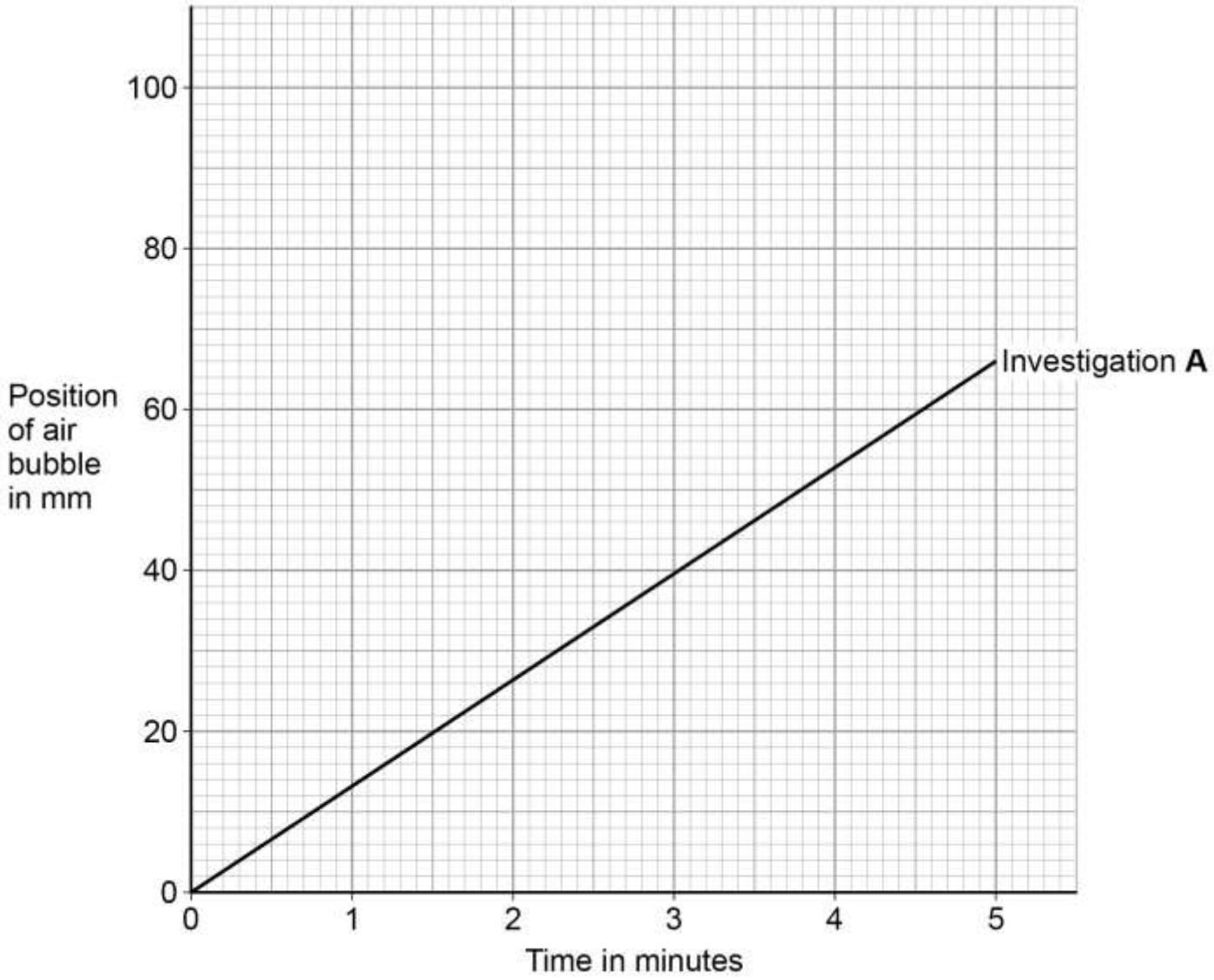
Figure 4 shows the results for investigation **A**.

Figure 4



1.3 The cross-sectional area of the capillary tube was 0.8 mm^2

Calculate the rate of water uptake for investigation A in mm^3/min

[3 marks]

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Rate =..... mm^3/min

1.4 Table 4 shows the results from investigation **B**.

Table 4

Time in minutes	Position of air bubble in mm
0	0
1	6
2	16
3	22
4	30
5	42

Plot the data from **Table 4** on **Figure 4**.

You should:

- Draw a line of best fit
- Label the line **B**.

[3 marks]

1.5 Investigation **C** was carried out in dry air at 25 °C

Draw a line on **Figure 4** to show the results you would expect for investigation **C.**

Label the line **C**.

[1 mark]

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1.6 The investigations were carried out in daylight.

The air bubble would **not** move if the investigations were done in the dark.

Explain why.

[3 marks]

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SECTION C

This is a challenge question to extend your understanding.

You should aim to spend **10 minutes** answering this section.

1. The leaves of most plants have stomata.

1.1 Name the cells which control the size of the stomata.

[1 mark]

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1.2 Give **one** function of stomata.

[1 mark]

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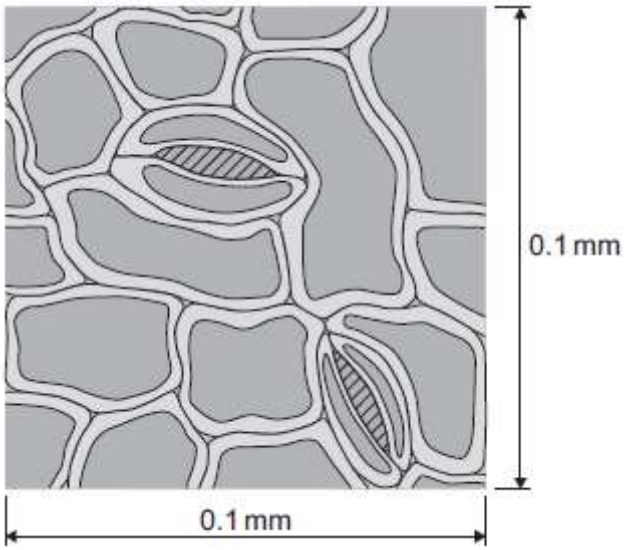
The image below shows part of the surface of a leaf.



The length and width of this piece of leaf surface are both 0.1 mm.

1.3 Calculate the number of stomata per mm^2 of this leaf surface.

[2 marks]

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.....

_____ per mm^2

1.4 A different plant species has 400 stomata per mm^2 of leaf surface.

Having a large number of stomata per mm^2 of leaf surface can be a disadvantage to a plant.

Give **one** disadvantage.

[1 mark]

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1.5 A student investigated the loss of water from plant leaves.

The student did the following:

Step 1: took ten leaves from a plant

Step 2: weighed all ten leaves

Step 3: hung the leaves up in a classroom for 4 days

Step 4: weighed all ten leaves again

Step 5: calculated the mass of water lost by the leaves

Step 6: repeated steps **1** to **5** with grease spread on the upper surfaces of the leaves

Step 7: repeated steps **1** to **5** with grease spread on both the upper and lower surfaces of the leaves.

All the leaves were taken from the same type of plant.

The table below shows the student's results.

Treatment of leaves	Mass of water the leaves lost in g
No grease was used on the leaves	0.98
Grease on upper surfaces of the leaves	0.86
Grease on upper and lower surfaces of the leaves	0.01

1.6 What mass of water was lost in 4 days through the upper surfaces of the leaves?

[1 mark]

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.....

Mass = _____ g

1.7 Very little water was lost when the lower surfaces of the leaves were covered in grease.

Explain why.

[3 marks]

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FEEDBACK SHEET

Overall Mark:	**/31**	**GRADE ACHIEVED:**	
		9 ☐	**5** ☐
		8 ☐	**4** ☐
		7 ☐	**3** ☐
		6 ☐	**U** ☐
Section A: Mark	/9		
Section B: Mark	/13		
Section C: Mark	/9		

Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding

Strengths:	☐ Basic Knowledge of Concepts ☐ Quality of Written Communication ☐ Working Scientifically ☐ Answering Examination Questions ☐ Analytical Skills **Others** (Topic Specific)	☐ Applications of Concepts ☐ Mathematical Skills ☐ Experimental Technique ☐ Previous Topics ☐ Problem Solving
Areas to Improve:	☐ Basic Knowledge of Concepts ☐ Quality of Written Communication ☐ Working Scientifically ☐ Answering Examination Questions ☐ Analytical Skills **Others** (Topic Specific)	☐ Applications of Concepts ☐ Mathematical Skills ☐ Experimental Technique ☐ Previous Topics ☐ Problem Solving

Progress:	Unsatisfactory	Satisfactory	Good	Outstanding
Working:	Below	In line with	Above	**(your target)**
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To improve further you need to:

☐ Carry out **independent** revision.	☐ Revise the equations.
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☐ Make corrections as indicated by the teacher.	☐ Check the correct amount of sig figs on answers.
☐ Attend intervention for this topic	☐ Check to convert values correctly.
☐ Include more information in responses.	☐ Show your full working out.
☐ Include more key words in responses.	☐ Check your calculations.
☐ Attend departmental revision sessions.	☐ Revise the science investigative skills.
☐ Read the questions carefully.	☐ Revise the key concepts of the topics.
☐ Explain your answers in more detail.	☐ Thoroughly check your work for mistakes.
☐ Carry out revision on Seneca Learning.	Other:

Student response

TASK 3: PHOTOSYNTHESIS

SPEC CHECK

Content	Achieved?
Photosynthesis is represented by the equation: $\text{carbon dioxide} + \text{water} \xrightarrow{\text{light}} \text{glucose} + \text{oxygen}$ Students should recognise the chemical symbols: CO_2, H_2O, O_2 and $C_6H_{12}O_6$. Students should be able to describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.	
Students should be able to explain the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll on the rate of photosynthesis. Students should be able to: • Measure and calculate rates of photosynthesis • Extract and interpret graphs of photosynthesis rate involving one limiting factor • Plot and draw appropriate graphs selecting appropriate scale for axes • Translate information between graphical and numeric form	
The glucose produced in photosynthesis may be: • Used for respiration • Converted into insoluble starch for storage • Used to produce fat or oil for storage • Used to produce cellulose, which strengthens the cell wall • Used to produce amino acids for protein synthesis. To produce proteins, plants also use nitrate ions that are absorbed from the soil.	
(HT only) These factors interact and any one of them may be the factor that limits photosynthesis. (HT only) Students should be able to explain graphs of photosynthesis rate involving two or three factors and decide which is the limiting factor.	
(HT only) Students should understand and use inverse proportion – the inverse square law and light intensity in the context of photosynthesis. (HT only) Limiting factors are important in the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit	
HT (only) Use data to relate limiting factors to the cost effectiveness of adding heat, light or carbon dioxide to greenhouses.	

Target Setting

In this assessed piece of work, what target should I look to achieve in completing this task? Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

What Topics Do I Know Well?	What Topics Do I Need to Revise?

SECTION A

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

1. Figure 16 shows the effect of light intensity and temperature on the rate of photosynthesis.

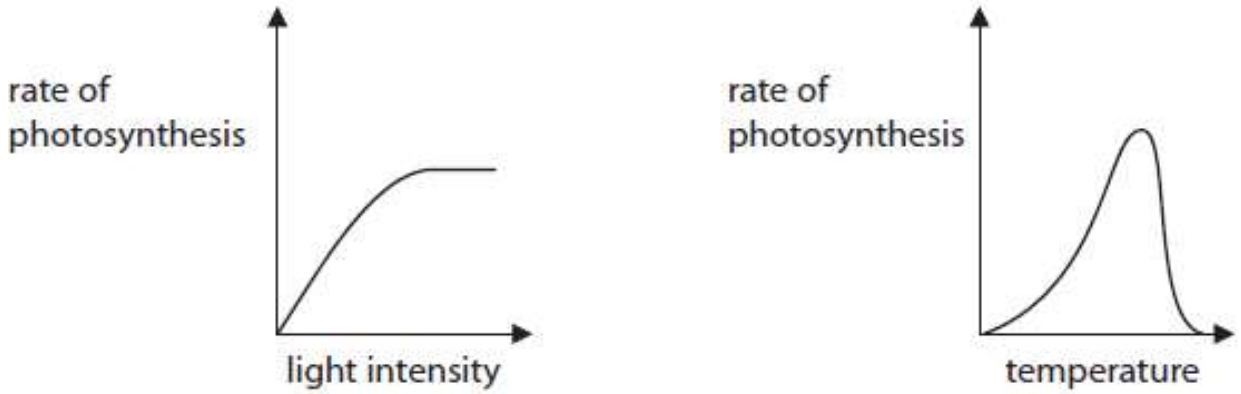

Figure 16

1.1 Describe the effect of light intensity on the rate of photosynthesis.

[2 Marks]

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1.2 Explain the effect of temperature on the rate of photosynthesis.

[2 Marks]

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A student measured the rate of photosynthesis using algal balls in a laboratory.

The tube of algal balls was kept at a temperature of 25 °C and was moved to different distances from a light source.

1.3 The results of this investigation showed that the rate of photosynthesis is

Tick **one** box only.

[1 Mark]

- ☐ **A** directly proportional to the distance from a light source
- ☐ **B** inversely proportional to light intensity
- ☐ **C** directly proportional to temperature
- ☐ **D** inversely proportional to the distance from a light source

1.4 Explain how substances are moved through a plant by transpiration and translocation.

[6 Marks]

SECTION B

This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

1. This question is about photosynthesis.

1.1 What is the correct balanced equation for photosynthesis?

[1 mark]

Tick **one** box.

- $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ ☐
- $O_2 + H_2O \rightarrow C_6H_{12}O_6 + CO_2$ ☐
- $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ ☐
- $6O_2 + 6CO_2 \rightarrow 6H_2O + C_6H_{12}O_6$ ☐

1.2 What type of reaction is photosynthesis?

[1 mark]

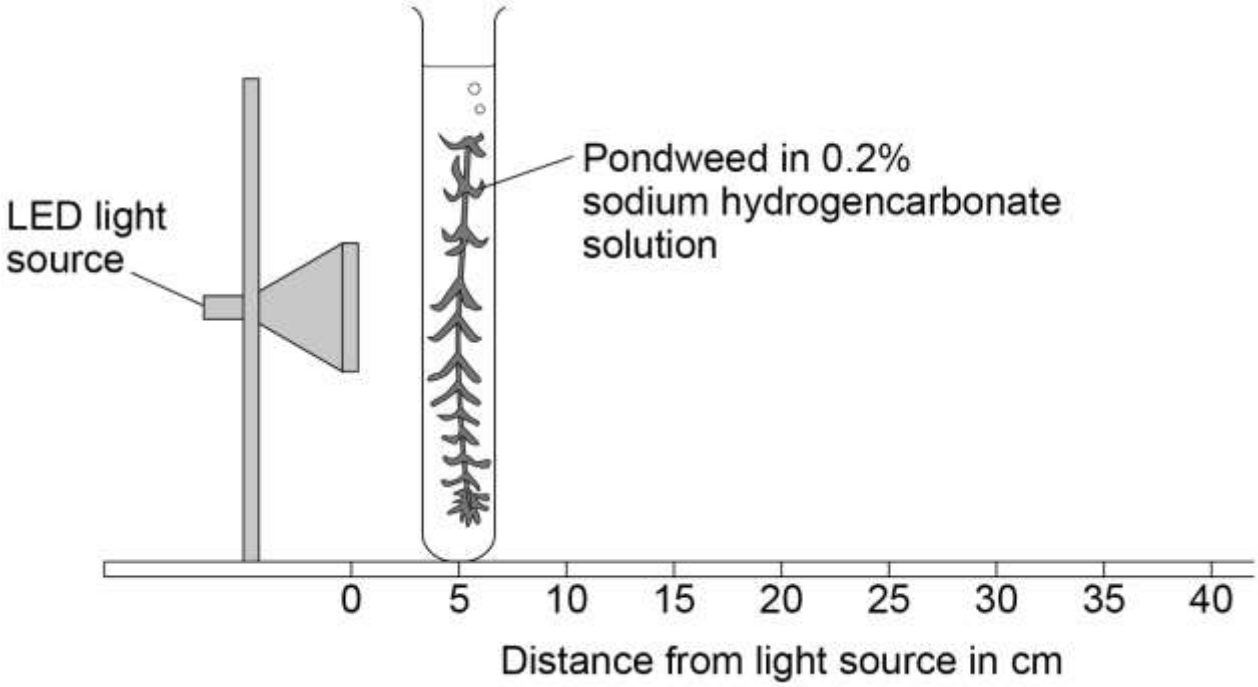
Tick **one** box.

- Aerobic ☐
- Endothermic ☐
- Exothermic ☐
- Oxidation ☐

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

Figure 5 shows the apparatus used.

Figure 5



Sodium hydrogencarbonate solution releases carbon dioxide gas for the pondweed.

This is the method used.

1. Place the pondweed at 5 cm from the light source.

2. Measure the rate of photosynthesis by counting the number of bubbles produced in 1 minute.

3. Repeat with the pondweed at 10 cm and at 20 cm from the light source.

1.3 Counting the number of bubbles produced in 1 minute is not an accurate way to measure the rate of photosynthesis.

Suggest **two** ways the method could be improved to measure the rate of photosynthesis more accurately.

[2 marks]

Way 1

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Way 2

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1.4 The LED light source does **not** get hot.

Explain why it is important that the pondweed remains at a constant temperature.

[2 marks]

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1.5 Light intensity can be calculated using the inverse square law:

$$I \propto \frac{1}{d^2}$$

Where I is light intensity and d is the distance of the pondweed from the light source.

The student placed the pondweed at 5, 10 and 20 cm from the light source.

Explain how light intensity changes as the distance of the pondweed from the light source is doubled.

You **must** include calculations in your answer.

[3 marks]

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1.6 The student's results are shown in **Table 1**

Table 1

Distance of the pondweed from the light source in cm	Number of bubbles produced in 1 minute
5	129
10	31
20	8

Predict how many bubbles of gas would be produced in 1 minute if the pondweed was placed 40 cm from the light source.

Give a reason for your prediction.

[2 marks]

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1.7 Describe how the student could change the method to investigate the effect of carbon dioxide concentration on the rate of photosynthesis.

You should include:

• How to change the independent variable

• **Two** control variables.

Use **Figure 5** to help you answer this question.

[3 marks]

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SECTION C

This is a challenge question to extend your understanding.

You should aim to spend **10 minutes** answering this section.

1. A student investigated how light intensity affected the rate of photosynthesis of seaweed in the laboratory. The light intensity was altered by moving a light source to a number of different distances from the seaweed.

1.1 Describe how the light intensity on the seaweed changed as the light source was moved.

[2 Marks]

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1.2 Use the inverse square law to calculate the missing values in the student's results shown in **Table 2**.

[2 Marks]

Table 2

Distance from light source in cm	10	20	35		70
Relative light intensity		60	20	15	5
Mean rate of oxygen production in bubbles per minute	20	20	14	10	2

1.3 Using the student's results, describe how light intensity affects the rate of photosynthesis of seaweed.

[2 Marks]

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FEEDBACK SHEET

Overall Mark:	**/31**	**GRADE ACHIEVED:**	
		9 ☐	**5** ☐
		8 ☐	**4** ☐
		7 ☐	**3** ☐
		6 ☐	**U** ☐
Section A: Mark	/11		
Section B: Mark	/14		
Section C: Mark	/6		

Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding

Strengths:	☐ Basic Knowledge of Concepts ☐ Quality of Written Communication ☐ Working Scientifically ☐ Answering Examination Questions ☐ Analytical Skills **Others** (Topic Specific)	☐ Applications of Concepts ☐ Mathematical Skills ☐ Experimental Technique ☐ Previous Topics ☐ Problem Solving
Areas to Improve:	☐ Basic Knowledge of Concepts ☐ Quality of Written Communication ☐ Working Scientifically ☐ Answering Examination Questions ☐ Analytical Skills **Others** (Topic Specific)	☐ Applications of Concepts ☐ Mathematical Skills ☐ Experimental Technique ☐ Previous Topics ☐ Problem Solving

Progress:	Unsatisfactory	Satisfactory	Good	Outstanding
Working:	Below	In line with	Above	**(your target)**
Effort:	Poor	Inconsistent	Good	Excellent

To improve further you need to:

☐ Carry out **independent** revision.	☐ Revise the equations.
☐ Complete outstanding work.	☐ Check the units on answers.
☐ Make corrections as indicated by the teacher.	☐ Check the correct amount of sig figs on answers.
☐ Attend intervention for this topic	☐ Check to convert values correctly.
☐ Include more information in responses.	☐ Show your full working out.
☐ Include more key words in responses.	☐ Check your calculations.
☐ Attend departmental revision sessions.	☐ Revise the science investigative skills.
☐ Read the questions carefully.	☐ Revise the key concepts of the topics.
☐ Explain your answers in more detail.	☐ Thoroughly check your work for mistakes.
☐ Carry out revision on Seneca Learning.	Other:

Student response

TASK 4: PHOTOSYNTHESIS INVESTIGATION

SPEC CHECK

Content	Achieved?
Photosynthesis is represented by the equation: $\text{carbon dioxide} + \text{water} \xrightarrow{\text{light}} \text{glucose} + \text{oxygen}$ Students should recognise the chemical symbols: CO_2, H_2O, O_2 and $C_6H_{12}O_6$. Students should be able to describe photosynthesis as an endothermic reaction in which energy is transferred from the environment to the chloroplasts by light.	
Students should be able to explain the effects of temperature, light intensity, carbon dioxide concentration, and the amount of chlorophyll on the rate of photosynthesis. Students should be able to: • Measure and calculate rates of photosynthesis • Extract and interpret graphs of photosynthesis rate involving one limiting factor • Plot and draw appropriate graphs selecting appropriate scale for axes • Translate information between graphical and numeric form	
The glucose produced in photosynthesis may be: • Used for respiration • Converted into insoluble starch for storage • Used to produce fat or oil for storage • Used to produce cellulose, which strengthens the cell wall • Used to produce amino acids for protein synthesis. To produce proteins, plants also use nitrate ions that are absorbed from the soil.	
(HT only) These factors interact and any one of them may be the factor that limits photosynthesis. (HT only) Students should be able to explain graphs of photosynthesis rate involving two or three factors and decide which is the limiting factor.	
(HT only) Students should understand and use inverse proportion – the inverse square law and light intensity in the context of photosynthesis. (HT only) Limiting factors are important in the economics of enhancing the conditions in greenhouses to gain the maximum rate of photosynthesis while still maintaining profit	
HT (only) Use data to relate limiting factors to the cost effectiveness of adding heat, light or carbon dioxide to greenhouses.	

Target Setting

In this assessed piece of work, what target should I look to achieve in completing this task? Please refer to your marking feedback for your target.

From your previous work, fill in the following boxes with your personal progress in Physics.

What Topics Do I Know Well?	What Topics Do I Need to Revise?

SECTION A

This is a revision question on a previous topic.

You should aim to spend **10 minutes** answering this section.

1. Some students investigated the effect of light intensity on the rate of photosynthesis.
They used the apparatus shown in **Figure 1**.

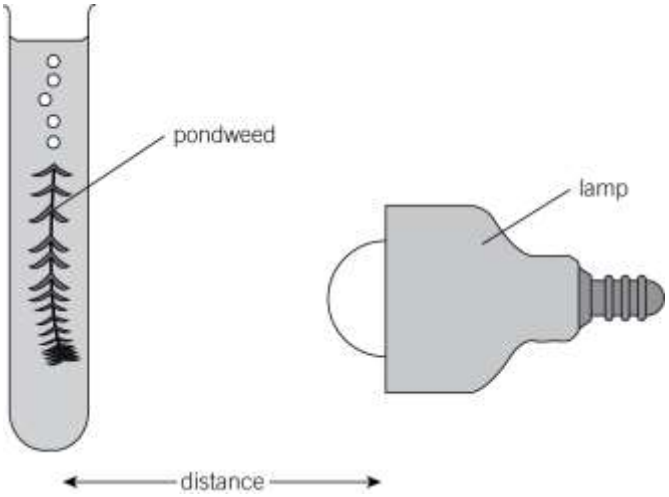

Figure 1

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.
The lamp gives out heat as well as light.

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

[1 Mark]

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Table 1 shows the students' results.

Table 1

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

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

1.2 What evidence is there for this in the table?

[1 Mark]

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

[1 Mark]

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Figure 2 shows a section through a plant leaf.

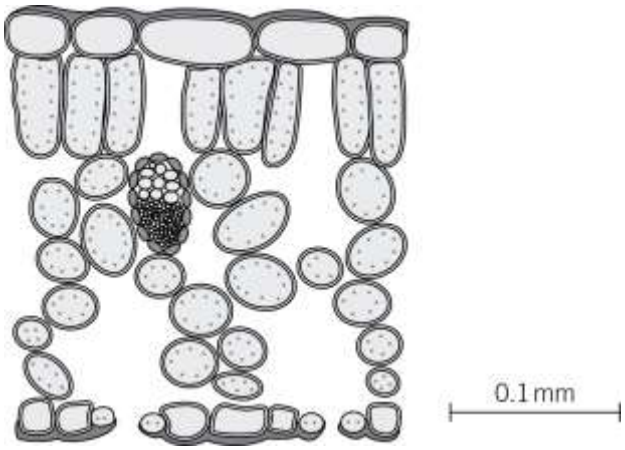

Figure 2

1.4 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 Marks]

SECTION B

This is a question to revise understanding carried out in lesson.

You should aim to spend **10 minutes** answering this section.

1.1 Complete the equation for photosynthesis.

[2 Marks]

light energy

..... + ... ⟶ ..... + oxygen

Scientists investigated how temperature affects the rate of photosynthesis.

The scientists grew some orange trees in a greenhouse.

They used discs cut from the leaves of the young orange trees.

The scientists used the rate of oxygen production by the leaf discs to show the rate of photosynthesis.

1.2 The leaf discs did not produce any oxygen in the dark.

Why?

[1 Mark]

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1.3 The leaf discs took in oxygen in the dark.

Explain why.

[2 Marks]

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In their investigation, the scientists measured the rate of oxygen release by the leaf discs in the light. The scientists then measured the rate of oxygen uptake by the leaf discs in the dark.

Figure 3 shows the effect of temperature on:

Oxygen production in the light

Oxygen production in the light added to oxygen uptake in the dark.

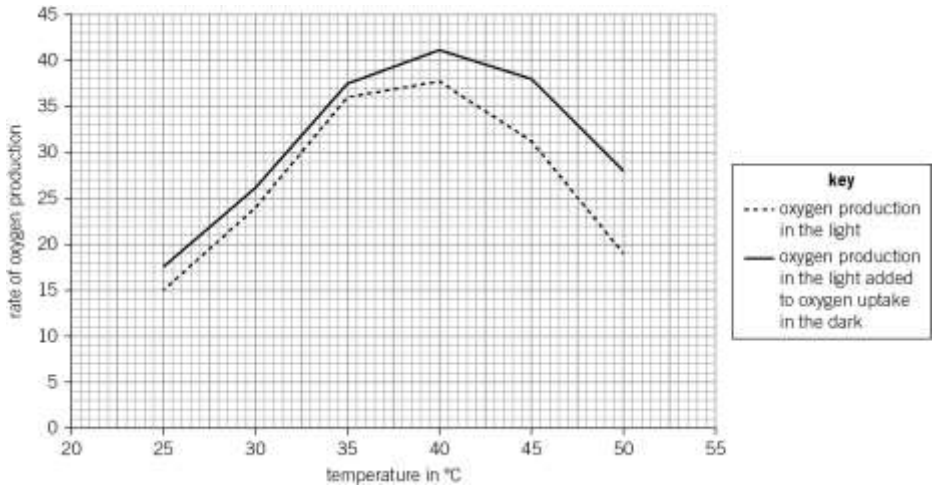

Figure 3

1.4 Describe the effect of temperature on oxygen production in the light.

[2 Marks]

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Explain the effect of temperature on oxygen production in the light when the temperature is increased:

1.5 from 25 °C to 35 °C

[1 Mark]

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1.6 from 40 °C to 50 °C.

[1 Mark]

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A farmer in the UK wants to grow orange trees in a greenhouse. He wants to sell the oranges he produces at a local market.

He decides to heat the greenhouse to 35 °C.

1.7 Explain why he should **not** heat the greenhouse to a temperature higher than 35 °C.

Use information from **Figure 4** in your answer.

[3 Marks]

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SECTION C

This is a challenge question to extend your understanding.

You should aim to spend **10 minutes** answering this section.

1. Green plants can make glucose.

1.1 Plants need energy to make glucose.

How do plants get this energy?

[2 Marks]

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1.2 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.

[4 Marks]

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FEEDBACK SHEET

Overall Mark:	**/27**	**GRADE ACHIEVED:**	
		9 ☐	**5** ☐
		8 ☐	**4** ☐
		7 ☐	**3** ☐
		6 ☐	**U** ☐
Section A: Mark	/9		
Section B: Mark	/12		
Section C: Mark	/6		

Knowledge and understanding shown	Unsatisfactory	Satisfactory	Good	Outstanding

Strengths:	☐ Basic Knowledge of Concepts ☐ Quality of Written Communication ☐ Working Scientifically ☐ Answering Examination Questions ☐ Analytical Skills **Others** (Topic Specific)	☐ Applications of Concepts ☐ Mathematical Skills ☐ Experimental Technique ☐ Previous Topics ☐ Problem Solving
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Student response

Acknowledgements

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This document has been produced for educational purposes only.

This document has been produced for the AQA GCSE Science Specification.