



Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

Forename(s)

Candidate signature

I declare this is my own work.

GCSE COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 1H

Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:

- a ruler
- a scientific calculator.

Instructions

- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

For Examiner's Use

Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

Information

- The maximum mark for this paper is 70.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.



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IB/M/Jun21/E7

8464/B/1H

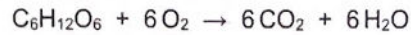
0 1

Plants absorb light for photosynthesis.

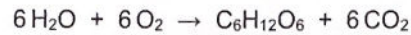
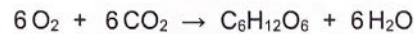
0 1 . 1

Which is the equation for photosynthesis?

[1 mark]

Tick (✓) **one** box.☐

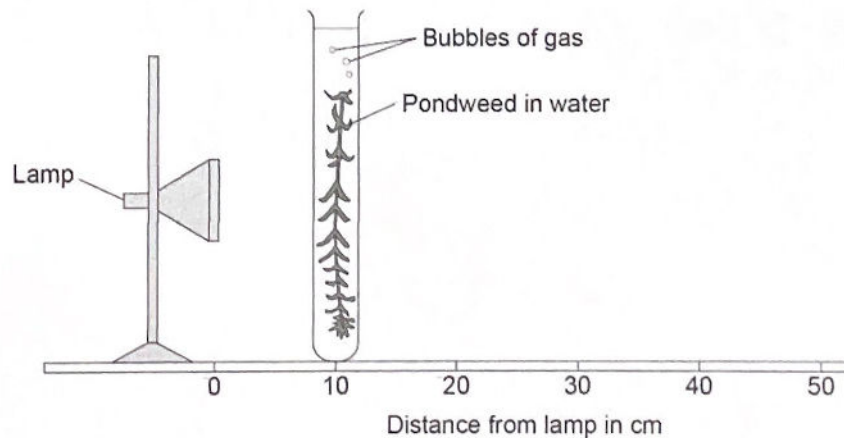
6 Carbon dioxide + 6 water → glucose + 6 oxygen

☒☐☐

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

Figure 1 shows the apparatus.

Figure 1



This is the method used.

1. Set up the apparatus as shown in **Figure 1**.
2. Place the pondweed 10 cm away from the lamp.
3. Switch on the lamp.
4. Record the number of bubbles of gas produced in 5 minutes.
5. Repeat steps 2 to 4 with the pondweed at different distances from the lamp.

0 1 . 2 What was the independent variable in this investigation?

[1 mark]

Tick (✓) **one** box.

Distance of the pondweed from the lamp

☒

Length of the piece of pondweed

☐

Number of bubbles of gas produced

☐

Time taken to collect the gas

☐

*This is the
variable that is
getting changed
between treatments*

Question 1 continues on the next page

Turn over ►



The lamp gets warm when it is on. This causes the temperature of the water to increase.

0 1 . 3

Explain how an increase in temperature would affect the results of this investigation.

[2 marks]

By increasing the temperature the enzymes involved in photosynthesis will work faster causing a faster rate of photosynthesis. Hence bubbles will be produced at a faster rate.

0 1 . 4

Suggest **one** way the investigation could be improved so the temperature of the water does **not** increase.

[1 mark]

~~Either~~ Place a beaker with water between the lamp and the tube.

OR

Place the tube into a beaker of temperature regulated water.

0 1 . 5

Suggest **two** improvements to the investigation so the results would be more valid.

Do **not** refer to controlling the temperature of the water.

[2 marks]

1

~~same as foundation~~

1. Carry out repeats, so anomalies can be identified and mean calculated.

2. Use the same lamp and bulb so light intensity is the same.

OR 3. have a controlled amount of carbon dioxide concentration in the tube available for the pondweed.

OR 4. Measure the exact volume of gas produced, as bubbles may differ in volume.



Table 1 shows the results.

Table 1

Distance of pondweed from the lamp in cm	Number of bubbles of gas produced in 5 minutes
10	120
20	56
30	31
40	16
50	10

0 1 . 6

Calculate the rate of photosynthesis when the pondweed was 40 cm from the lamp.

Give the rate of photosynthesis as the number of bubbles of gas produced per minute. [1 mark]

no. of bubbles in 5 min = 16

no. of bubbles in 1 min = $\frac{\text{no. of bubbles in 5 min}}{5} = \frac{16}{5} = 3.2 = 3$

Rate = 3 bubbles of gas produced per minute

can't have 0.2 bubbles.

0 1 . 7

Give one conclusion that can be made from Table 1.

[1 mark]

As light intensity decreases the rate of photosynthesis decreases.

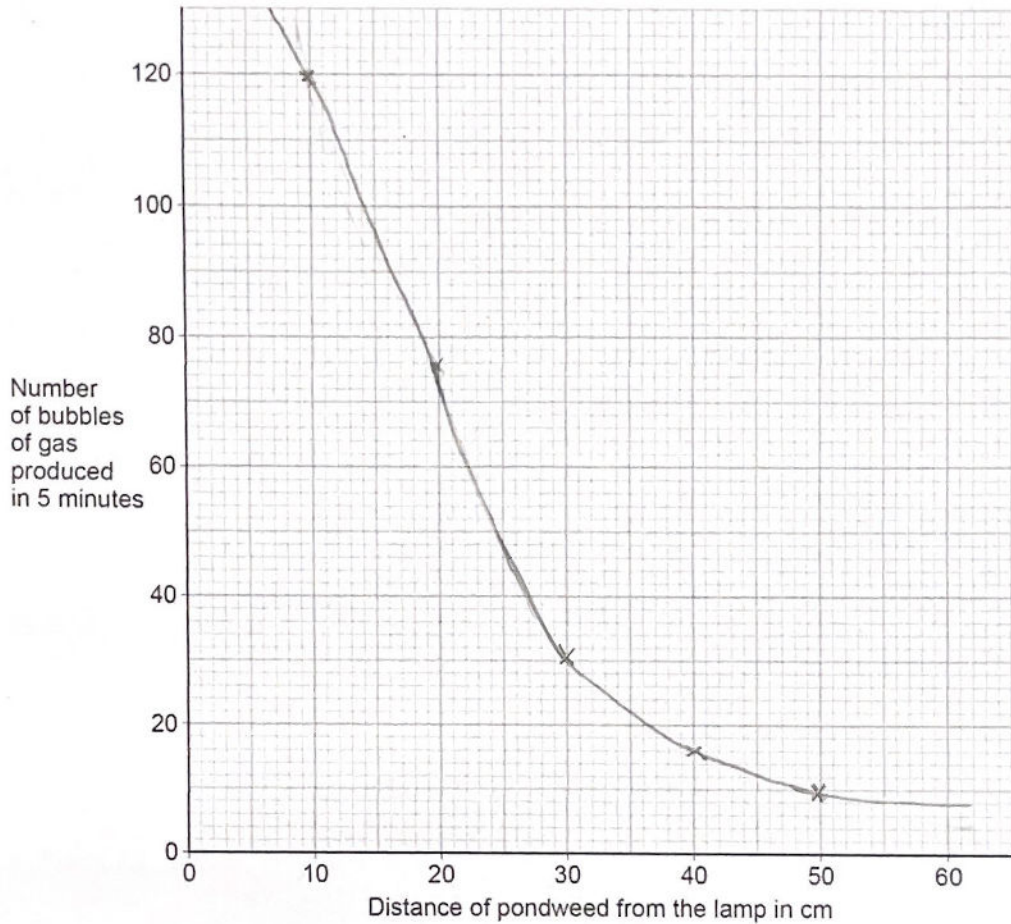


0 1 . 8 Plot the data from Table 1 on Figure 2.

Draw a line of best fit.

[3 marks]

Figure 2



0 1 . 9 Predict the number of bubbles that would be produced in 5 minutes if the pondweed was 60 cm from the lamp.

Use Figure 2.

[1 mark]

Number of bubbles produced in 5 minutes = 8

13

Turn over ►



0 2

Describe how to test a sample of food for protein, starch and sugar.

~~Score~~

Give the colours that would be seen if the food sample contained protein, starch and sugar.

[6 marks]

For all 3 test food samples should be ground up and mixed with water, so reagents colour change can be observed.

For proteins, Biuret's reagent should be added. This light blue reagent will turn purple / lilac if protein is present.

For starch, Iodine solution should be added. The orange / brown solution will turn blue / black if starch is found in the sample.

Finally for sugars Benedict's reagent needs to be added. The light blue mixture then needs to be put in a water bath to be heated to 65°C or above.

If little sugar is present the light blue reagent will turn green / yellow. However if there is more sugar present, the light blue solution will turn brick red / orange.

6



0 3

Fermentation in yeast is used in the manufacture of bread and alcoholic drinks.

The equation for fermentation is:



0 3

1

Fermentation is an exothermic reaction.

What does exothermic mean?

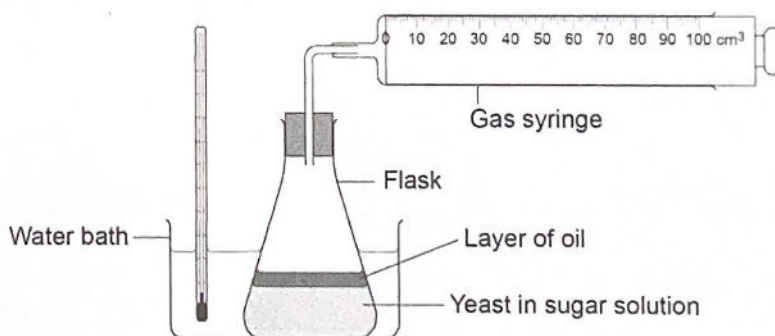
[1 mark]

exothermic a reaction in which energy is released to
the surrounding.

A student investigated the effect of temperature on fermentation in yeast.

Figure 3 shows the apparatus.

Figure 3



This is the method used.

1. Mix yeast with sugar solution in a flask.
2. Pour a layer of oil over the surface of the mixture.
3. Put the flask in a water bath at 2°C and leave for 20 minutes.
4. Attach a gas syringe.
5. Record the volume of gas collected every 5 minutes for 30 minutes.
6. After 30 minutes move the flask to a water bath at 35°C .
7. Continue to record the volume of gas collected every 5 minutes.

- 0 3 . 2 Suggest why a layer of oil was needed on the surface of the mixture.

[1 mark]

To keep oxygen out creating anaerobic conditions so only fermentation reaction will take place.

- 0 3 . 3 Suggest why the mixture was left for 20 minutes before the gas syringe was attached.

[1 mark]

Allow the cells and the mixture to cool to 2°C , so results are not measured while reaction is not actually at 2°C .

Question 3 continues on the next page

Turn over ►



Steps 1 to 4 of the method were repeated at 35 °C.

The volume of gas collected was recorded every 5 minutes for 45 minutes.

Table 2 shows the results for both flasks for the first 30 minutes.

Table 3 shows the results for the last 15 minutes, when both flasks were at 35 °C.

Table 2

Time in minutes	Volume of gas collected in cm ³	
	Flask at 2 °C	Flask at 35 °C
0	0	0
5	0	26
10	0	52
15	0	78
20	0	98
25	0	108
30	0	115

Table 3

Time in minutes	Volume of gas collected in cm ³	
	Flask at 2 °C moved to 35 °C	Flask kept at 35 °C
35	2	120
40	7	123
45	22	124



0 3 . 4

Explain the results from 0 minutes to 45 minutes for the flask that was at 2 °C and was then moved to 35 °C.

Use Table 2 and Table 3.

[3 marks]

No gas was collected in the first 30 minutes while at 2°C, as temperature was too low for enzymes to catalyse any reactions. No fermentation happened at 2°C. Once flask is moved into 35°C fermentation starts again so gas is produced.

0 3 . 5

Explain the results from 0 minutes to 45 minutes for the flask kept at 35 °C.

Use Table 2 and Table 3.

[4 marks]

gas collected is at a steady rate for the first 15 minutes, after which it gets slower and slower with each time interval. This is as food starts to run out for the yeast to metabolise in fermentation. As initially rate is steady for carbon dioxide production it indicates temperature is ideal for fermentation.

10

Turn over for the next question

Turn over ►



0 4

Pathogens are microorganisms that cause diseases.

Gonorrhoea, malaria and measles are three diseases in humans.

0 4 . 1

Draw **one** line from each disease to the pathogen that causes the disease.

[3 marks]**Disease****Pathogen**

Gonorrhoea

Bacterium

Malaria

Fungus

Protist

Measles

Virus

Question 4 continues on the next page

Turn over ►

0 4 . 2

Malaria is transmitted by mosquitos.

Male mosquitos can be sterilised so they are infertile.

The spread of malaria is reduced by releasing sterile mosquitos into the environment.

Explain how releasing sterile mosquitos reduces the spread of malaria.

[2 marks]

The released sterile males will still compete with other males for reproduction. As some females will reproduce with sterile males no offspring will be produced by the female either. Hence in the next generation there will be fewer mosquitos, so less mosquitos to transmit the malaria.

Pathogens also cause diseases in plants.

Figure 4 shows a rose black spot fungal spore and a tobacco mosaic virus.

Figure 4

Rose black spot fungal spore



16 μm

Tobacco mosaic virus



$2.5 \times 10^{-7} \text{ m}$

Images are not to the same scale

0 4 . 3

Name the piece of equipment used to view the virus.

[1 mark]

electron microscope, as light microscope doesn't have a high enough resolution to make a virus visible



- 0 4 . 4 How many times longer is the fungal spore than the virus?

Use Figure 4.

[3 marks]

$$\text{Spore} = 16 \mu\text{m} \quad \text{virus} = 2.5 \times 10^{-7} \text{ m}$$

$$\hookrightarrow 1 \text{ m} = 1000 \text{ mm} = 1000000 \mu\text{m}$$

$$\hookrightarrow 16 \mu\text{m} = \frac{16}{1000000} \text{ m} = 1.6 \times 10^{-5} \text{ m}$$

$$\frac{1.6 \times 10^{-5}}{2.5 \times 10^{-7}} = \underline{\underline{64}}$$

OR

$$2.5 \times 10^{-7} \text{ m} = 0.25 \mu\text{m}$$

Number of times longer = 64

$$\Rightarrow \frac{16 \mu\text{m}}{0.25 \mu\text{m}} = \underline{\underline{64}}$$

- 0 4 . 5 Explain why plants infected with tobacco mosaic virus grow slowly.

[3 marks]

Yellowish brown discoloration on leaves due to less chlorophyll in cells. This causes the leaf ~~and~~ to absorb less light so reducing the rate of photosynthesis. Photosynthesis reduced will lead to production of less glucose which is needed by the plant for growth. So as there is less photosynthesis growth will be slower.

12

Turn over for the next question

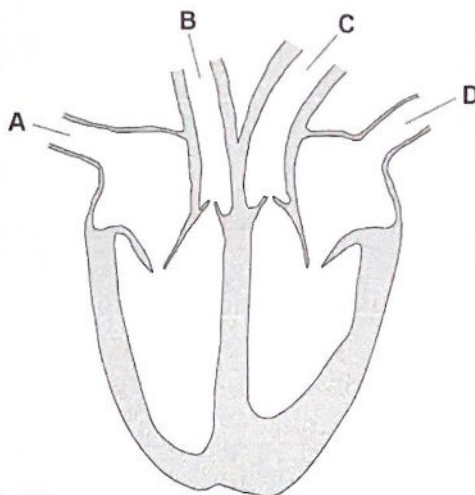
Turn over ►



0 5

Figure 5 shows the human heart.

Figure 5



0 5 . 1

Which blood vessel transports blood with the highest oxygen concentration into the heart?

[1 mark]

Tick (✓) one box.

A ☐B ☐C ☒D ☒

pulmonary vein
~~brings~~ brings blood
from lungs to the heart.

0 5 . 2

Blood pressure is a measure of the force of the blood against the walls of the blood vessels.

Which blood vessel transports blood at the highest pressure?

[1 mark]

Tick (✓) one box.

A ☐B ☐C ☒D ☐

aorta
takes blood
from the heart to the
rest of the body



0 5 . 3

What is the correct order for blood flowing through the heart to the lungs?

[1 mark]

Tick (✓) **one** box.

left atrium → left ventricle → pulmonary artery

☐

left atrium → left ventricle → pulmonary vein

☐

· right atrium → right ventricle → pulmonary artery

☒

· right atrium → right ventricle → pulmonary vein

☐

blood goes
from the right
side of the heart
to the lungs

1, atrium

2, ventricle

Question 5 continues on the next page

arteries ~~too~~ are
vessels that leave the
heart

Turn over ►



Every year thousands of people in the UK have heart attacks.

A heart attack is caused when the heart muscle cells do **not** get enough oxygen, causing the cells to die.

0 5 . 4

Statins and stents are two treatments used to reduce the risk of someone having a heart attack.

Evaluate the use of statins compared with the use of a stent to reduce the risk of a heart attack.

[6 marks]

Statins are a drug that can easily be taken orally, with no need for invasive procedures, so no risk of infections. They reduce blood cholesterol level, so preventing the depositing of fatty materials in the walls of arteries. Hence maintaining a good flow of blood to the heart tissue. This cost effective method is simple to use. However, the drug may have side effects, such as muscle pain. Also, drug needs to be taken for a long term regularly, leading to problem if person forgets to take them.

Stents have the advantage of being a one time procedure providing a life long solution to maintaining blood flow to the heart. They bring about an immediate change, with fast recovery for patients.

On the other hand any invasive procedure comes with a risk of infection, heart attack or bleeding.

In conclusion, a stent may be a better option due to its long term effectiveness and ~~not~~ immediate effect.



0 5 . 5

Many people who survive a heart attack get out of breath easily when they exercise gently.

Explain why heart attack survivors get out of breath easily.

[4 marks]

Heart muscle is damaged, so the heart is unable to work as effectively as before in pumping blood. As oxygen is transported to tissues for respiration in the blood, ~~a lower~~ less blood being pumped at a time causes an oxygen ~~debt~~ debt. To account for this the breathing rate increases to supply more oxygen.

Question 5 continues on the next page

Turn over ►



Scientists have developed patches of beating heart cells to repair damaged heart tissue.

The patches are placed onto areas of the heart where cells have died. New cells grow to replace the dead cells.

The patches are made using a person's own cells that are converted into stem cells.

0 5 . 6

Explain why stem cells are used to make the patches.

[2 marks]

Stem cells are a special type of cells that are undifferentiated. Meaning they can turn into any type of cell including muscle cells.

0 5 . 7

The scientists could have used human embryonic stem cells to make the patches.

Give **two** advantages of using stem cells made from the person's own cells, rather than using embryonic stem cells.

[2 marks]

- 1 cells will not be rejected as they are the same type of cells
- 2 embryonic stem are controversial as they may damage the embryo itself



0 6

This question is about plant transport systems.

0 6 . 1

Describe how water is transported from the soil to the atmosphere through a plant.

[4 marks]

Water is absorbed by osmosis into the root hair cells in the roots. From here it travels up to the leaves, through the stem through the ~~top~~ a vessel called the xylem in a passive process called transpiration. This is caused by water evaporating from the leaves and diffusing out of the plant through the stomata. This creates a pulling effect on other water molecules that get pulled up from the roots.

0 6 . 2

Dissolved sugars are moved through a plant in phloem tissue.

What is the name of the process that moves dissolved sugars through phloem tissue?

[1 mark]

translocation

Question 6 continues on the next page

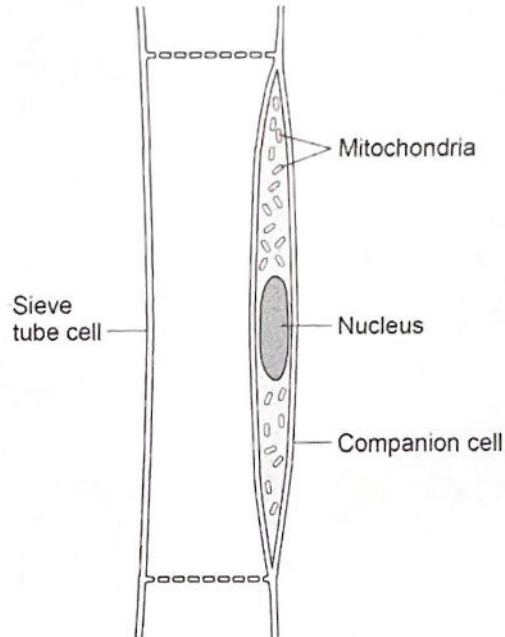
Turn over ►



Phloem tissue is made of sieve tube cells and companion cells.

Figure 6 shows a section of phloem tissue.

Figure 6



0 6 . 3 Explain one way sieve tube cells are specialised for their function.

Use Figure 6.

[2 marks]

Have pores in their cell membranes between other sieve cells. This allows dissolved molecules like sugars to move inbetween.

OR

No nucleus and very few cell structures to provide space for the movement of substances.



0 6 . 4

What does the structure of the companion cells suggest about the process that moves dissolved sugars through the phloem tissue?

Give a reason for your answer.

Use Figure 6.

[2 marks]

The companion cells contain many mitochondria that can release plenty of energy. This energy can be used in active transport to transport substances up or down.

0 6 . 5

Describe why it is important that dissolved sugars are moved both upwards and downwards in a plant.

[3 marks]

Sugars are produced in the leaves by photosynthesis. These sugars then need to be transported up to the shoots like the meristem for growth, as well as down to roots which respire using up these sugars but don't photosynthesise so can't produce it for themselves.

12

END OF QUESTIONS

