B4
PHOTOSYNTHESIS & RESPIRATION
TEST 1

GCSE
BIOLOGY
AQA - COMBINED SCIENCE

Materials
For this paper you must have:
• Ruler
• Pencil, Rubber, Protractor and Compass
• 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
• Do all rough work in this book. Cross out any rough work you don't want to be marked

Information
• The marks for the questions are shown in brackets
Respiration can happen aerobically or anaerobically.

Respiration transfers energy from glucose.

(a) Draw one line from each type of respiration in human cells to the correct information.

<table>
<thead>
<tr>
<th>Type of respiration in human cells</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic respiration</td>
<td>Uses oxygen</td>
</tr>
<tr>
<td>Anaerobic respiration</td>
<td>Uses carbon dioxide</td>
</tr>
<tr>
<td></td>
<td>Produces lactic acid</td>
</tr>
<tr>
<td></td>
<td>Produces ethanol</td>
</tr>
</tbody>
</table>

(b) The table below shows the amount of energy released by aerobic and anaerobic respiration.

<table>
<thead>
<tr>
<th>Energy in kJ transferred from 1 g of glucose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aerobic respiration</td>
</tr>
<tr>
<td>Anaerobic respiration</td>
</tr>
</tbody>
</table>

Suggest why human cells might respire anaerobically, even though only a small amount of energy is transferred.

___________________________________________________________________
___________________________________________________________________

(1)
Yeast is used in the brewing and baking industries.

Why is yeast used in these industries?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

This question is about gases in the air.

The diagram below represents a molecule found in air.

O=C=O

(a) What is the formula of the molecule shown in the diagram above?

Tick one box.

- Co2
- 2CO
- CO2
- CO²

(b) What is the name of the molecule shown in the diagram above?

You may use the periodic table to help you.

___________________________________________________________________

(Total 7 marks)
(c) The percentage of oxygen in air is 21%.

The mass of air in a classroom was 220 kg

Calculate the mass of oxygen in the classroom.

___________________________________________________________________
___________________________________________________________________

Mass of oxygen = ________________ kg

(1)

Carbon monoxide is an air pollutant.

(d) Describe how carbon monoxide is produced from fuels.
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)

(e) Carbon monoxide can decrease the concentration of oxygen in the blood.

Which part of the blood would be most affected by carbon monoxide?

Tick one box.

Red blood cells

Plasma

Platelets

White blood cells

(1)
(f) What two effects could a decreased concentration of oxygen in the blood have on body cells?

Tick two boxes.

- Cell death
- Decreased respiration rate
- Faster cell division
- Faster cell growth
- More energy released

(g) Some air pollutants cause acid rain.

Give one problem caused by acid rain.

___________________________________________________________________
___________________________________________________________________

(Total 9 marks)
This question is about photosynthesis.

(a) What are the **two** products of photosynthesis?

Tick **two** boxes.

- Carbon dioxide
- Chlorophyll
- Glucose
- Oxygen
- Water

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

**Figure 1** shows the apparatus.

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 30 seconds.
3. Repeat the investigation with the pondweed at different distances from the light source.
(b) How could the student measure the rate of photosynthesis more accurately?

Tick two boxes.

- Count the number of bubbles produced in 1 minute
- Measure the change in mass of the pondweed in 30 seconds
- Measure the volume of gas produced in 30 seconds
- Place the pondweed further from the light source
- Use water instead of sodium hydrogencarbonate solution

(c) The LED light source does not get hot.

Why is this important?

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(1)

The table below shows the student’s results.

<table>
<thead>
<tr>
<th>Distance of light source from pondweed in cm</th>
<th>Number of bubbles produced in 30 seconds</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>40</td>
</tr>
<tr>
<td>10</td>
<td>13</td>
</tr>
<tr>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>20</td>
<td>2</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
</tr>
<tr>
<td>30</td>
<td>0</td>
</tr>
</tbody>
</table>
(d) Calculate the number of bubbles produced in 2 minutes when the light source was 10 cm from the pondweed.

Number of bubbles produced in 2 minutes = ______________

(e) Plot the data from the table above on Figure 2

Draw a line of best fit.

Figure 2

(f) Give one conclusion that can be made from these results.

___________________________________________________________________

___________________________________________________________________

(Total 10 marks)
The diagram below shows a sweet potato plant.

The sweet potatoes grow underground and can be cooked and eaten.

The table below shows some of the nutrients in cooked sweet potato.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Mass in grams per 100 grams of cooked sweet potato</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>73.83</td>
</tr>
<tr>
<td>Protein</td>
<td>2.01</td>
</tr>
<tr>
<td>Fat</td>
<td>0.15</td>
</tr>
<tr>
<td>Total carbohydrate of which sugars</td>
<td>20.71</td>
</tr>
<tr>
<td></td>
<td>6.55</td>
</tr>
<tr>
<td>Fibre</td>
<td>3.30</td>
</tr>
</tbody>
</table>

(a) After cooked sweet potato is digested, sugars (including glucose) pass into the blood.

Give **two** other soluble molecules that would pass into the blood after cooked sweet potato is digested.

1. _________________________________________________________________
2. _________________________________________________________________

(2)
(b) Calculate the mass of sugars in 180 g of cooked sweet potato.

Use the information from the table above.

___________________________________________________________________
___________________________________________________________________

Mass of sugars = _____________________ g

(1)

(c) The sweet potatoes found underground contain starch.

Explain how starch in the sweet potato is produced from carbon dioxide in the air.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(6)
(Total 9 marks)
Students investigated the effect of light intensity on the rate of photosynthesis in pondweed. The diagram shows the equipment the students used.

This is the method used.

1. Place the lamp 50 cm from the pondweed.
2. Count the number of bubbles of gas released in two minutes.
3. Repeat steps 1–2 with the lamp at different distances from the pondweed.

(a) The students could not make a firm conclusion because their method did not control enough variables.

Give two variables the students have not controlled that would affect the rate of photosynthesis.

1. 
2. 

The table shows the students’ results.

<table>
<thead>
<tr>
<th>Distance of lamp from the pondweed in cm</th>
<th>Number of bubbles released in two minutes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
</tr>
<tr>
<td>50</td>
<td>5</td>
</tr>
<tr>
<td>40</td>
<td>10</td>
</tr>
<tr>
<td>30</td>
<td>12</td>
</tr>
<tr>
<td>20</td>
<td>25</td>
</tr>
<tr>
<td>10</td>
<td>22</td>
</tr>
</tbody>
</table>
(b) Calculate the mean rate of bubbles produced per minute when the lamp was 10 cm from the pondweed.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
Mean rate = ____________________ bubbles per minute

(3)

(c) The mean number of bubbles released when the lamp was 30 cm away from the plant was greater than when the lamp was 50 cm away.

How many times greater?

___________________________________________________________________
Number of times greater = ____________________

(1)

(d) The students wanted to find out if different wavelengths of light affect the number of bubbles released.

Describe how the method could be adapted to find the effect of different wavelengths of light.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)

(Total 8 marks)
The graph shows the rate of blood flow through different organs at rest and during exercise.

(a) Determine the total volume of blood that flows through the brain in 1 hour.

__________________________________________________________

__________________________________________________________

Volume = ____________________ cm$^3$

(1)

(b) Look at the blood flow through the skeletal muscle.

Calculate how many times the blood flow increases by during exercise compared to at rest.

__________________________________________________________

__________________________________________________________

__________________________________________________________

Answer = ____________________
(c) Explain why the blood flow to the skeletal muscles increases during exercise.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(d) Arteries and veins have different structures and different functions.

Explain how the different structure of arteries and veins relates to their different functions.

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

Eukaryotic cells respire continuously to transfer energy.

(a) Give two uses of energy transferred by respiration in eukaryotes.

1. _________________________________________________________________
2. _________________________________________________________________

(Total 12 marks)
(b) Name the cell structure in a eukaryotic cell where aerobic respiration occurs.

___________________________________________________________________

(1)

(c) Muscle cells and plant cells can respire anaerobically.

Compare the processes of anaerobic respiration in muscle and plant cells.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(4)

(d) Anaerobic respiration in muscle cells creates an oxygen debt.

What does oxygen debt mean?

___________________________________________________________________

___________________________________________________________________

(1)

(Total 8 marks)
This question is about photosynthesis.

(a) What is the correct balanced equation for photosynthesis?

Tick one box.

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

(b) What type of reaction is photosynthesis?

Tick one box.

- Aerobic
- Endothermic
- Exothermic
- Oxidation
A student investigated the effect of light intensity on the rate of photosynthesis.

The diagram below shows the apparatus used.

![Diagram of the apparatus used in the experiment](image)

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.

(c) 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.

1. _________________________________________________________________
   ___________________________________________________________________
2. _________________________________________________________________
   ___________________________________________________________________

(2)
(d) The LED light source does not get hot.

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

___________________________________________________________________
___________________________________________________________________
___________________________________________________________________
___________________________________________________________________

(2)

(e) 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)
(f) The student’s results are shown in the table below

<table>
<thead>
<tr>
<th>Distance of the pondweed from the light source in cm</th>
<th>Number of bubbles produced in 1 minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>129</td>
</tr>
<tr>
<td>10</td>
<td>31</td>
</tr>
<tr>
<td>20</td>
<td>8</td>
</tr>
</tbody>
</table>

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)

(g) 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 the diagram above to help you answer this question.

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

___________________________________________________________________

(3) (Total 14 marks)