

GCSE

BIOLOGY

AQA - COMBINED SCIENCE

MARK SCHEME

B4

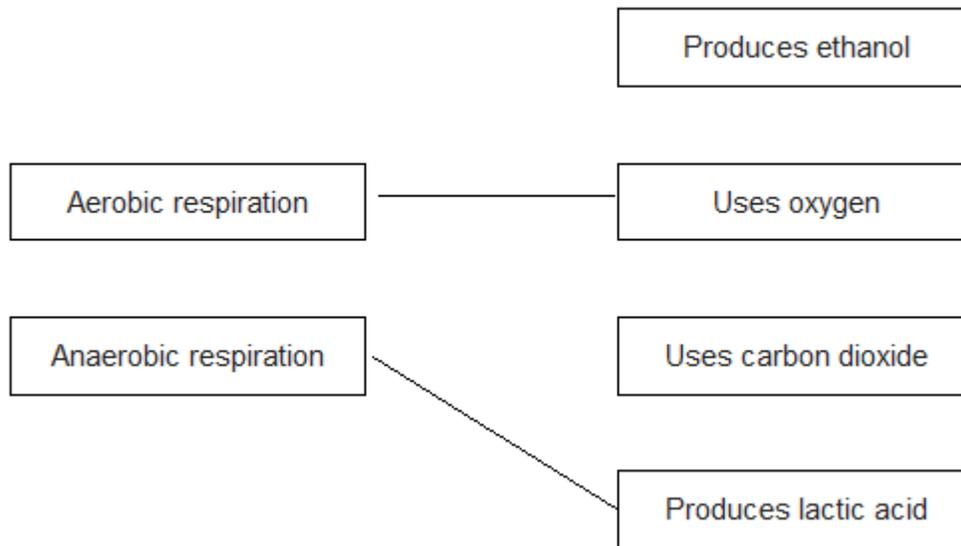
PHOTOSYNTHESIS & RESPIRATION

TEST 1

Mark schemes

1

(a)



an extra line from a LH box negates that mark

2

(b) any **one** from:

- not enough oxygen present (for aerobic respiration)
- more energy required for exercise (than can be transferred by aerobic respiration)

1

allow named example for exercise

(c) produces carbon dioxide

1

produces ethanol

1

plus any **two** from:

- (carbon dioxide) makes bread rise
- (carbon dioxide) makes beer / cider / (some) wines fizzy
- (ethanol) is the alcohol in beer / cider / wine / spirits

2

[7]

2

(a) CO₂

1

(b) carbon dioxide

ignore formulae

ignore carbon oxide

*do **not** accept carbon monoxide*

1

- (c) 46.2 (kg)
allow 46 (kg) 1
- (d) (fossil / hydrocarbon) fuels burn / combust
allow named fossil fuels 1
- in a limited supply of oxygen / air
allow lack of oxygen / air 1
- an answer of incomplete combustion gains 2 marks*
- (e) red blood cells 1
- (f) cell death 1
- decreased respiration rate 1
- (g) any **one** from:
ignore breathing problems
- damages buildings / bridges / statues
allow damages iron / metal / limestone structures
 - harms / kills plants / trees
 - harms living organisms in ponds / rivers / lakes
allow harms aquatic organisms
- 1
- [9]**
- 3** (a) glucose 1
- oxygen 1
- extra ticks negates marks*
- (b) count the number of bubbles produced in 1 minute 1
- measure the volume of gas produced in 30 seconds 1
- extra ticks negates marks*

- (c) any **one** from:
- to control the temperature
allow so pondweed / solution did not warm up
 - temperature affects the rate of photosynthesis
allow correct description of effect of temperature on rate
allow high temperatures denature enzymes
ignore references to limiting factors
- 1
- ignore reference to 'it'*

(d) 52

1

- (e) all points plotted correctly
- allow $\pm \frac{1}{2}$ a square*
allow 1 mark for three points correctly plotted
- 2

smooth curve drawn through all points

ignore extensions of line / curve unless inconsistent with line / curve drawn

1

(where a bar chart has been plotted)
allow 1 mark for all bars plotted correctly
if points are plotted as well as bars, ignore bars

- (f) any **one** from:
- the nearer the light source to the pondweed the faster the rate of photosynthesis
allow the nearer the light source to the pondweed the faster the bubbles produced
 - the greater the light intensity the faster the rate of photosynthesis
allow the greater the light intensity the faster the bubbles produced
allow the closer the light source the more the plant photosynthesises
ignore more bubbles are produced with no reference to rate
allow oxygen for bubbles
*do **not** accept carbon dioxide*
- 1
- allow converse statements for all marking points*

[10]

4	<p>(a) any two from:</p> <ul style="list-style-type: none"> • amino acids • glycerol • fatty acids <p style="padding-left: 40px;"><i>do not accept fat</i></p> <p style="padding-left: 40px;"><i>allow salt / minerals</i></p> <p style="padding-left: 40px;"><i>allow vitamins</i></p>	2
	<p>(b) 11.79 (g)</p> <p style="padding-left: 40px;"><i>allow 11.8 (g) or 12 (g)</i></p>	1
	<p>(c) Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.</p> <p style="text-align: right;">5–6</p> <p>Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.</p> <p style="text-align: right;">3–4</p> <p>Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.</p> <p style="text-align: right;">1–2</p> <p>No relevant content</p> <p style="text-align: right;">0</p> <p>Indicative content</p> <ul style="list-style-type: none"> • carbon dioxide enters the leaf through stomata • glucose / sugars produced by photosynthesis (in leaves) • some detail of photosynthesis • transport / translocation (of glucose / sugars) • in phloem • glucose is converted to starch • (starch is a) long chain of glucose / sugar molecules • starch as storage (of glucose / sugars) 	[9]
5	<p>(a) temperature</p> <p style="text-align: right;">1</p> <p>carbon dioxide concentration</p> <p style="padding-left: 40px;"><i>allow type of pondweed</i></p> <p style="padding-left: 40px;"><i>allow mass of pondweed</i></p>	1

(b) $\frac{(34 + 31 + 31 =)96}{3}$

allow 1 mark for
 $\frac{22 + 34 + 31 + 31 =)118}{4} = 29.5$

2

$\frac{32}{2(\text{min})}$

= 16(.0) (bubbles per minute)

allow ecf from incorrect mean

1

(c) 2.3(333)

1

(d) place different coloured filters over the lamp bulb

or

use different coloured light bulbs

1

keep the lamp the same distance from the pondweed each time

1

[8]

6

(a) 36 000 (cm³)

1

(b) 11600 / 1200

1

9.66666r

allow any number of decimals

1

(c) muscles need more energy (for contraction)

1

(so) more oxygen / glucose needed

need at least one reference to 'more' for full marks

allow so more carbon dioxide / thermal energy needs to be removed

1

(for) increased respiration

1

(d)

Level 3: Relevant points (differences / functions) are identified, given in detail and linked logically to form a clear account.	5-6
Level 2: Relevant points (differences / functions) are identified and there are attempts at logical linking. The resulting account is not fully clear.	3-4
Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
No relevant content	0
Indicative content <ul style="list-style-type: none">• artery has a thicker wall• (because) artery has to withstand higher pressure• artery has thicker layer of elastic tissue / fibres• (so) it can stretch• (so) artery returns to original size / shape• artery has thicker layer of muscle• to maintain a force on the blood• vein has valves• (valves) prevent backflow of blood• artery carries blood away from the heart• vein carries blood towards the heart ignore references to oxygenated / deoxygenated blood	

6

[12]

7

(a) any **two** from:

- synthesis of new molecules
allow named molecule eg starch / glycogen / cellulose / lipids / fats / proteins / hormones / antibodies
- for active transport
- to keep warm (in mammals / birds)
allow description
allow to keep warm (in animals)
allow for movement (in animals)
allow for transmission of nerve impulses (in animals)

2

- (b) mitochondria / mitochondrion 1
- (c) both occur without oxygen 1
- both release (a small amount of) energy 1
- muscle cells produce lactic acid but plant cells produce ethanol 1
- muscle cells do **not** produce carbon dioxide but plant cells do
marks can be awarded from correct word or balanced symbol equations 1
- (d) the amount of oxygen needed to react with the lactic acid formed
*allow the amount of oxygen needed to break down
 or oxidise the lactic acid* 1

[8]

- 8** (a) $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$ 1
- (b) endothermic 1
- (c) measure the volume of gas released
allow use a measuring cylinder / capillary tube / (gas) syringe 1
- increase length of time
*allow sensible length of time
 allow video the investigation so you could re-count the bubbles later
 allow repeat the measurement at each distance several times **and** calculate a mean
 ignore references to using other distances* 1

(d) temperature affects **rate** of photosynthesis
or
temperature affects **rate** of bubble production
allow correct description of effect of temperature on rate

1

(because) reaction / photosynthesis is controlled by **enzymes**
allow high temperatures denature enzymes
enzymes being denatured must be linked to high temperature

1

(e) evidence of squaring for **two** distances that double:
25 **and** 100
or
100 **and** 400

1

calculate $1/d^2$ for **two** distances that double:
0.04 **and** 0.01
or
1/25 **and** 1/100
or
0.01 **and** 0.0025
or
1/100 **and** 1/400

allow 2 marks for these calculations without working
ignore calculations for a third distance as long as two
where the distance doubles are correct

1

(therefore as distance doubles) light intensity is quartered

1

(f) 2 (bubbles would be produced)

1

(as) very little light / energy for photosynthesis to occur
*do **not** accept no light*

1

allow 2 marks for a quarter of the bubbles are produced
as light distance doubles so 2 bubbles would be expected

- (g) (independent variable)
use different concentrations of sodium hydrogencarbonate solution
allow three concentration values
ignore different concentrations of carbon dioxide

1

(control variables)

max 2 marks for control variables

any **two** from:

- distance from light source
allow light intensity
ignore light unqualified
ignore same lamp
- temperature of solution
- same plant
allow type / size of plant
- time for plant to equilibrate
allow time for plant to adjust to different solution
ignore time unqualified

2

[14]