

MARK SCHEME

GCSE

BIOLOGY

AQA - COMBINED SCIENCE

B 4 - TEST 5

BIOENERGETICS

Advanced

Mark schemes

- 1.** insufficient / no oxygen available 1
- for (just) aerobic respiration
- or**
- respires anaerobically 1
- [2]**
- 2.** (i) $0.25 \times 100 / 25$
gains 1 mark
- but**
- 1%
gains 2 marks 2
- (ii) muscle contraction / limb movement / moving around / chewing
heartbeat / breathing / internal muscle activity
maintaining body temperature / keeps body warm
active uptake synthesising substances (*reject growth*)
any three for 1 mark each 3
- [5]**
- 3.** (a) (i) carbon dioxide / CO₂ (*reject CO*)
- (ii) oxygen / O₂ / O (water vapour neutral)
for 1 mark each 2
- (b) (provides) energy
for one mark 1
- (c) starch insoluble therefore water not taken in by osmosis
or
sugar is soluble / has small molecules may diffuse out therefore lost
(ignore ref. to cells bursting)
- or**
starch has large molecules
cannot diffuse therefore retained
for 1 mark each 3
- [6]**

- 4.** (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]**

- 5.** (a) 5624
- allow 2 marks** for:
- correct HR = 148 **and** correct SV = 38 plus wrong answer / no answer
- or**
- only one value correct **and** ecf for answer
- allow 1 mark** for:
- incorrect values **and** ecf for answer
- or**
- only one value correct

3

- (b) (i) **Person 2** has low(er) stroke volume / SV / described
 eg **Person 2** pumps out smaller volume each beat
 do **not** allow **Person 2** has lower heart rate 1
- (ii) **Person 1** sends more blood (to muscles / body / lungs) 1
- (which) supplies (more) oxygen 1
- (and) supplies (more) glucose 1
- (faster rate of) respiration **or** transfers (more) energy for use
 ignore aerobic / anaerobic
 allow (more) energy release
 allow aerobic respiration transfers / releases more energy (than anaerobic)
 do **not** allow makes (more) energy 1
- removes (more) CO₂ / lactic acid / heat
 allow less oxygen debt
- or** less lactic acid made
or (more) muscle contraction / less muscle fatigue
 if no other mark awarded,
 allow person 1 is fitter (than person 2) for max 1 mark 1

[9]

6.

- (a) (i) 120 1
- (ii) 11 760 **or**
 correct answer from candidate's answer to (a)(i)
 correct answer with or without working
 if answer incorrect
 120 × 98 **or**
 candidate's answer to (a)(i) × corresponding SV gains 1 mark
 if candidate uses dotted line / might have used dotted line(bod) in
 (a)(i) **and** (a)(ii) no marks for (a)(i) but allow full ecf in (a)(ii) eg 140
 × 88 = 12320 gains 2 marks 2
- (b) trained athlete has higher stroke volume / more blood per beat 1
- same volume blood expelled with fewer beats
- or** for same heart rate more blood is expelled 1

(c) increased aerobic respiration

or

decreased anaerobic respiration

allow correct equation for aerobic respiration

accept don't have to respire anaerobically

1

increased energy supply / need

1

less lactic acid formed

or to breakdown lactic acid **or** less O₂-debt

1

can do more work **or** can work harder / faster / longer

accept muscle contraction for work

or less fatigue / cramp / pain

1

[9]

7.

(a) control

1

to check that the indicator colour does not change on its own

or

to check any changes in colour are due to the organisms

1

(b) (tube) **E**

1

most carbon dioxide

1

(due to) only respiration occurring

allow no carbon dioxide used for photosynthesis

*allow 1 mark **max** if chose tube **D** and give a correct reason*

1

(c) the amount of carbon dioxide produced by respiration equalled amount absorbed for photosynthesis

1

[6]

8.

(a) + light = + photosynthesis
+ light = + photosynthesis to a limit
limit depends on temp/CO₂ levels
+ CO₂ = + photosynthesis
+ temp = + photosynthesis
each for 1 mark

5

(b) need to raise optimum levels
when one other raised
to get max/economic yield
each for 1 mark

2

[7]

9.

(a) (i) oxygen produced

1

(ii) any **one** from:

- average / mean / median
ignore reliable / precise / accurate
- some may be anomalous
allow some may not float

1

(b) (i) *do not allow answers in terms of time only*
if candidate answers in terms of comparing rate of change then the
rate of change of photosynthesis must be in the correct direction for
1 mark

any **two** from:

- low intensity / below 12.5 / 2.5 - 12.5 (units of light) flat wrack / it, rate of photosynthesis faster **or** saw wrack rate of photosynthesis slower
allow any value in range
- high intensity / above 12.5 / 12.5 - 15 (units of light) flat wrack / it, rate of photosynthesis slower **or** saw wrack rate of photosynthesis faster
allow any value in range
- same (rate) at 12.5 units

2

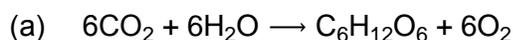
(ii) any **two** from:

- saw wrack receives less light
accept converse if clear reference to bladder wrack
 - less photosynthesis
if first and second responses, 'less' needed only once
- or**
less carbohydrate / sugar / starch production
- when tide is in **or** at high tide **or** any tide above low tide
*accept saw wrack covered by water / submerged longer / more
reference to position on shore is insufficient*

2

[6]

10.



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]