MARK SCHEME

GCSE

BIOLOGY

AQA - COMBINED SCIENCE

B 4 - TEST 3

BIOENERGETICS

Intermediate

Mark schemes

1.

(a) carbon dioxide + water → (glucose) + oxygen

allow reactants in either order

allow correct formulae, balancing not required

1

(b) chlorophyll

1

(c) glucose (produced in photosynthesis) is converted into starch

1

(d) starch could be broken down (into sugar)

1

(e) so the colour of the iodine solution / result can be seen

1

(f) any **one** from:

- turn off Bunsen / flame before collecting ethanol
- use a water bath to heat the ethanol

allow idea that there are no naked flames near the ethanol

1

(g) **A** orange / brown

1

B black / blue-black

1

[8]

2.

(a) temperature

1

carbon dioxide concentration

allow type of pondweed

allow mass of pondweed

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]

3. (a) water + carbon dioxide → oxygen + glucose

extra box ticked negates mark

1

(b) **Level 3 (5–6 marks):**
A coherent method is described with relevant detail, which demonstrates a broad understanding of the relevant techniques and procedures. The steps in the method are logically ordered. The method would lead to the production of valid results.

Level 2 (3–4 marks):
The bulk of the method is described with mostly relevant detail, which demonstrates a reasonable understanding of the relevant scientific techniques and procedures. The method may not be in a completely logical order and may be missing some detail.

Level 1 (1–2 marks):
Simple statements are made which demonstrate some understanding of some of the relevant scientific techniques and procedures. The response may lack a logical structure and would not lead to the production of valid results.

0 marks:
No relevant content

Indicative content

- description of how the apparatus would be used
- reference to control intensity of light / brightness
- use of ruler to measure distance of light from beaker / pondweed
- reference to varying colour of light or use of different filters
- plant releases gas / oxygen
- measure number of bubbles / volume of gas produced
- same length of time
- reference to control of temperature
- reference to control / supply of carbon dioxide in water
- do repeats and calculate a mean

6

(c) rate does not increase further if light intensity increased beyond 20

allow graph levels off after 20

1

(d) any **one** from:

- temperature
- carbon dioxide (concentration)
- amount of chlorophyll

allow number of chloroplasts

1

[9]

4. (i) any **two** from

* (heart) more muscular

accept bigger

* (heart) more powerful

accept more efficient

accept stronger

2

(ii) * pauses longer between (heart) beats

accepts beats more slowly

accept heart rate decreases

* less fast around the heart

recovers more quickly not just 'heart healthier'

do not credit pulse rate slower

2

[4]

5. (a) (i) 6 peaks in heart rate

*accept 6 increases / spikes **or** goes very high 6 times*

allow heart rate increases each time he runs

1

(ii) 2.5 / 2½

allow 2 minutes 30 seconds

*do **not** accept 2.3 / 2:3 / 2.30*

1

(b) *more / faster / a lot **must** be stated at least once for full marks*

(more) oxygen supplied / needed

allow less anaerobic (respiration)

or (more) aerobic respiration

***or** prevents oxygen debt*

1

(more) glucose / sugar / food supplied / needed

ignore feeding

1

(more) energy needed / released

allow energy produced / made

1

(more) carbon dioxide / heat / lactic acid removed (from muscles) **or** more cooling

or less lactic acid formed

1

[6]

6. (a) (to) stop them falling in the solution

or

to stop them drowning (in the solution)

1

(b) **Level 2 (3–4 marks):**
A detailed and coherent explanation is given of how the droplet moves, clearly and logically linked to the process of respiration.

Level 1 (1–2 marks):
Simple statements are made about movement of the water droplet, but any attempts at explaining the reason or linking the movement to the process of respiration are unclear and poorly structured.

0 marks:
No relevant content

Indicative content

- water droplet moves towards the maggots / boiling tube

Explanation:

- the oxygen in the boiling tube is used up in respiration
- (and) the carbon dioxide released from respiration is absorbed by solution **A**
- which causes a pressure difference
- so air is drawn into the tube
- bringing the water droplet with it.

4

(c) *x* axis: Temperature in °C

both needed for the mark

y axis: Rate of respiration in units

1

(d) repeat the experiment at 30 °C

1

(e) 10.5

allow range 10.4–10.8

1

[8]

7. (a) (i) without <u>oxygen</u>

allow not enough oxygen

ignore air

ignore production of CO_2

ignore energy

1

(ii) more / high / increased lactic acid (at end)

allow approximate figures (to show increase)

ignore reference to glucose

1

(b) (i) 1.5

allow only 1.5 / 1½ / one and a half

1

(ii) increases at first **and** levels off

ignore subsequent decrease

1

suitable use of numbers eg

rises to 10 / by 9 (dm^3 per min)

or

increases up to 1.5 (min) / levels off after 1.5 (min) (of x axis timescale)

allow answer in range 1.4 to 1.5

or

after the first minute (of the run)

1

(iii) supplies (more) oxygen

1

supplies (more) glucose

1

need 'more/faster' once only for full marks

*allow removes (more) CO_2 / lactic acid / heat as an alternative for either marking point one **or** two, **once** only*

for (more) respiration

1

releases (more) energy (for muscle contraction)

*do **not** allow energy production or for respiration*

1

[9]

8. (a) LHS – glucose

1

RHS – water

allow H_2O / H2O

1

(b) so the earthworms' body temperature would change to 20°C

1

(c) (i) 56 or 55 or 54

*if incorrect answer given accept 60 - 5 for **1** mark*

*or 60 – 6 for **1** mark*

*or 60 – 4 for **1** mark*

2

(ii) one-tenth of answer to (c)(i) eg 5.5

1

(at 10°C / lower temperature):

lower rate of respiration

allow chemical reactions slower or enzymes less active

ignore breathing

do not allow anaerobic

1

worms less active / worms release less energy / worms use less energy

1

(d) (i) anomalous result / not in line with other data / does not fit the pattern

1

(ii) more representative / more reliable / can check 'repeatability' / see if get similar values / identify anomalies

ignore valid / more fair

ignore reproducible

ignore 'to remove' anomalies

do not accept more accurate or more precise

1

[10]

9. (a) to transfer / provide / give release energy

***or** production of ATP / adenosine triphosphate (molecules)*

accept to give heat

1

(b) (i) $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

accept any other

n : 6n : 6n : 6n ratio

do not credit if any other changes have been made

1

(ii) glucose

do not credit sugar / sucrose

1

(c) (i) any **two** from

large surface

thin (surface)

moist (surface)

(with a good) blood supply

2

(ii) carbon dioxide

accept water vapour

do not credit just water

1

(d) (i) anaerobic (respiration)

1

(ii) any **three** from

in mitochondria

glucose decomposes / breaks down / reacts

***or** glucose → lactic acid for (2) marks*

to give lactic acid

***or** breathing hard*

***or** lactic acid → CO2 + water*

causing pain

(leaving an) oxygen debt

(quick) source of energy

(but) less efficient than aerobic respiration

accept less efficient than with oxygen

3

[10]