

MARK SCHEME

GCSE

BIOLOGY

AQA - TRIPLE SCIENCE

B 4 - TEST 4

BIOENERGETICS

Intermediate

Mark schemes

- 1.** (a) $C_6H_{12}O_6$ 1
- (b) atmospheric air contains less carbon dioxide than exhaled air
allow converse 1
- (flask B goes more cloudy because) carbon dioxide is produced in (aerobic) respiration (by woodlice)
do not accept anaerobic respiration 1
- (c) for comparison / to compare
allow answers in the context of the investigation e.g.
- or**
to check that no other factor / variable is influencing the results
to prove that the results obtained were due to the woodlice respiring and nothing else
- or**
to prove that the woodlice produced the carbon dioxide and nothing else 1
- (d) (flask **A**) would remain colourless
ignore references to clear
allow not cloudy 1
- (flask **B**) would remain colourless 1
- (e) lactic acid 1
- (f) alcohol / ethanol 1
- [8]
- 2.** (a) The starch is stored for use later
no mark if more than one box is ticked 1

- (b) (i) any **two** from:
- do **not** accept temperature*
 - apply list principle*
 - ignore reference to time*
- carbon dioxide (concentration)
 - light intensity
 - light colour / wavelength
- allow 1 mark for light if neither intensity or colour are awarded*
- pH
 - size / amount of pondweed / plant
 - same / species / type pondweed
 - amount of water in the tube
- ignore amount of water alone*
- 2
- (ii) number / amount of bubbles **or** amount of gas / oxygen
- allow volume of bubbles (together)*
- ignore 'the bubbles' unqualified*
- 1
- (relevant reference to) time / named time interval
- allow how long it bubbles for*
- do **not** accept time bubbles start / stop*
- ignore speed / rate of bubbling*
- ignore instruments*
- do **not** accept other factors eg temperature*
- accept how many bubbles per minute for 2 marks*
- 1
- (c) (i) temperature
- allow heat / cold / °C*
- 1
- (ii) carbon dioxide / CO₂
- allow CO₂*
- do **not** accept CO²*
- 1

[7]

3.

(a) any **one** from:

- respiration
- formation of proteins
- formation / breakdown of glycogen
- breakdown of (excess) protein **or** formation of urea
- photosynthesis **or** formation of glucose / starch (in plants)

ignore formation of carbohydrates

1

allow other correct reference to metabolic reactions in cells

ignore reference to digestion

(b) males have a higher metabolic rate than females after five years of age

1

the mean metabolic rate of females decreases faster than males up to 25 years of age

1

each additional tick negates a mark

(c) $\frac{17}{53} \times 100$

1

32.075472...

allow correct rounding of this to at least 4 significant figures

1

32.1

allow a correct reduction to 3 significant figures from an incorrect calculation for marking point 2

1

an answer of 32.1 scores 3 marks

(d) any **two** from:

allow converse

- (person) R heart rate rose / increased more slowly than (person) S
- (person) R heart rate levelled off whereas (person) S continued to increase
- (person) R heart rate rose less (overall / after 5 minutes of exercise) than S

allow correct use of figures

e.g. R increased (overall) by 39 bpm / 65% and S by 54 bpm / 69%

ignore lack of units

2

(e) correct scale and axis labelled
allow min(s)
*do **not** accept 'm'*
the zero is not required on the x-axis 1

all points plotted correctly (to within $\pm \frac{1}{2}$ square)
allow 4 or 5 correct plots for 1 mark 2

line joined point to point or correct curved line of best fit 1

(f) $\frac{132 - 78}{12}$
allow $\frac{54}{12}$
allow sequential deductions of 12 four or five times 1

4.5 (minutes) / 4½ minutes / 4 minutes 30 seconds / 4:30
*do **not** accept 4:50 or 4 minutes 50 seconds* 1
an answer of 4.5 minutes scores 2 marks

(g) **Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced. 5-6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced. 3-4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear. 1-2

No relevant content 0

Indicative content

- two groups of people – non-smokers and smokers
- have at least five people in each group or large groups
- get each person to do (named) exercise
- controlled variables:
 - same number of people in each group or large groups
 - same gender
 - same level of activity / exercise
 - same age
 - no health issues / illnesses
 - same type of exercise
 - same time for exercise
- record heart rate for each person before and after exercise
- calculate increase in heart rate for each person after exercise
- compare results for each group

for **level 3**, students should refer to at least 5 smokers and 5 non-smokers, carrying out exercise with control variables and a means of determining an increase in heart rate

for **level 2**, students should refer to 'groups' of smokers and non-smokers exercising

[20]

4.

(a) $6\text{H}_2\text{O}$

in the correct order

1

$\text{C}_6\text{H}_{12}\text{O}_6$

1

(b) (i) control

do not accept 'control variable'

allow:

to show the effect of the organisms

or

to allow comparison

or

to show the indicator doesn't change on its own

1

(ii) snail respire

1

releases CO₂

1

(iii) turns yellow

1

plant can't photosynthesise so CO₂ not used up

1

but the snail (and plant) still respire so CO₂ produced

1

[8]

5.

(a) LHS – glucose

1

RHS – water

allow H₂O / 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]

6.

(a) in yeast:

'it' equals yeast

makes alcohol / makes CO² / does not make lactic acid

do not allow uses / involves alcohol / CO²

1

(b) (i) any two from:

allow amount of yeast

- volume of yeast / suspension
- volume of sugar / solution
- concentration of sugar
amount of sugar = max 1 for sugar
- temperature
(total) volume = 1 mark if no other volume
ignore concentration of yeast

2

(ii) most / more CO² given off with fructose **or**
'it' equals fructose

faster CO² production

or

faster respiration

allow faster fermentation

*do **not** allow aerobic respiration*

so (rate of) alcohol production will be greatest / more (with fructose)

1

1

[5]

7.

(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]

8.

(a) (i) brain

1

(ii) skin

1

(iii) 1/25 **or** 4% **or** 0.04 **or** 1 in 25 **or** 1:25 **or** 1 out of 25

$$\text{allow } \frac{1000}{25000}$$

1

(b) any **two** from:

- increased / high heart rate / pulse rate
do not allow pumps more blood unqualified
- dilation / widening of arteries / arterioles (to skeletal muscles)
accept vasodilation unqualified
do not accept reference to veins / capillaries

or

less blood flow to other organs

- increased stroke volume / described

2

(c) *ignore references to breathing*

more respiration / description

or

more energy required **or** to provide more energy

1

respiration / process described → CO₂

do not accept anaerobic respiration

1

CO₂ diffuses into blood

1

[8]