

## Mark schemes

### Q1.

- (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*
- allow other correct reference to metabolic reactions in cells*
- ignore reference to digestion*
- 1
- (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*

(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*

## Q2.

(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

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**Q3.**

- (a) less carbon dioxide used  
**or** higher carbon dioxide (concentration) in jar  
*do not allow no carbon dioxide used or no change in carbon dioxide* 1
- because less photosynthesis **or** light was a limiting factor  
*do not allow no photosynthesis* 1
- (b) magnesium / Mg  
*do not allow manganese / Mn*  
*allow iron / Fe*  
*ignore nitrates* 1

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**Q4.**

- (a) no oxygen (is used) 1
- (b) muscles become fatigued / stop contracting 1
- because not enough energy is transferred 1
- (c) carbon dioxide 1
- (d) count the bubbles  
**or**  
 measure volume of gas 1
- in a given time 1
- (e) brewing / bread making  
*allow other suitable use of fermentation in food industry*

## Q5.

(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

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(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) CO<sub>2</sub> / 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

**Q6.**

- (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 / CO<sub>2</sub>  
*allow CO2*  
*do not accept CO<sup>2</sup>* 1

**Q7.**

(a) any **one** from:

*ignore 'check temperature'*

- add a water bath
- heat screen
- use LED
- low energy bulb / described

1

(b) (i) rate / number of bubbles decreases

*accept converse with reference to increasing light **or** shorter distance*

**or**

less oxygen / gas released

*ignore reference to rate of photosynthesis*

1

(ii) temperature / CO<sub>2</sub> (concentration)

*accept 'it was too cool' **or** not enough CO<sub>2</sub>*

*accept number of chloroplasts / amount of chlorophyll*

*allow heat*

*allow CO<sub>2</sub>*

*do **not** allow CO<sub>2</sub>*

1

(c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1-2 marks)**

There is a brief description of at least 1 tissue **or** at least 1 function of an indicated part of the leaf.

The account lacks clarity or detail.

**Level 2 (3-4 marks)**

There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.

**Level 3 (5-6 marks)**

There is a detailed description of most of the structures and their functions.

**Examples of responses:**

- epidermis
- cover the plant
- mesophyll / palisade
- photosynthesises
- phloem
  
- xylem
- transport.

**The following points are all acceptable but beyond the scope of the specification:**

- (waxy) cuticle – reduce water loss
- epidermis – no chloroplasts so allows light to penetrate
- stomata / guard cells – allow CO<sub>2</sub> in (and O<sub>2</sub> out) **or** controls water loss
- palisade (mesophyll) – many chloroplasts to trap light  
– near top of leaf for receiving more light
- spongy (mesophyll) – air spaces for rapid movement of gases

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**Q8.**

- (a) rate of photosynthesis increases  
**or**  
number of bubbles produced (in one minute) increases  
**or**  
volume of gas / oxygen produced (in one minute) increases  
*allow decreases / stays the same throughout*

1

- (b) light intensity

1

- (c) reduces the effect of heat from the lamp  
**or**  
prevents temperature affecting photosynthesis

1

- (d) 52

1

- (e) should be 62  
**or**  
 is to 3 s.f. / not rounded  
*allow inconsistent number of significant figures / decimal places* 1
- (f) the numbers of bubbles at each distance are similar 1
- (g) x-axis correctly labelled (colour of light) **and** bars identified as correct colour  
*bars can be identified by labels beneath the x-axis or with a key* 1
- bars plotted correctly  
*all 4 correct = 2 marks 3 correct = 1 mark*  
*if wrong type of graph drawn, max 2 marks* 2
- (h) blue light gives highest (rate of) photosynthesis  
*allow ecf from candidate's graph allow blue light is best* 1
- green light gives the lowest (rate of) photosynthesis  
*allow green light is worst* 1
- (i) energy  
*in this order only* 1
- cell wall(s)  
*allow cell*  
*do **not** accept (cell) membrane* 1
- starch / fat / oil / lipid 1