4.4 Bioenergetics

Biology (Separates) Higher Topic Test Markscheme

Mark scheme 01.1

$\frac{(18.5 + 19.3 + 19.5)}{3}$

or

$\frac{57.3}{3}$

1

19.1 (cm^3/hour)

Allow an answer correctly calculated using only two correct values

1

[2 marks]

Mark scheme 01.2

(a) 14.2

1

(b) Any **one** from:

- Scale / value was misread
  Allow measurement error
- There was air / oxygen in the syringe / measuring cylinder / apparatus
- The lamp / light was moved
  Allow light intensity changed
  Ignore different bulb / lamp unqualified
- Temperature changed
- Had different mass / length of pondweed
- Pondweed had not acclimatised

Ignore human error
Ignore references to counting bubbles or time

1

(c) Did not use it in calculation (of mean)

1

[3 marks]

Mark scheme 01.3

Any **one** from:

- Light (intensity)
  Allow distance / power / colour of lamp / light
- Carbon dioxide (concentration)
- Pondweed size / amount
- Pondweed species
  Allow same (piece of) pondweed

*Do **not** accept temperature*
Ignore time

[1 mark]

Mark scheme 02.1

$\frac{17}{53} \times 100$

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*

[3 marks]

Mark scheme 02.2

$\frac{132-78}{12}$
allow $\frac{54}{12}$
Allow sequential deductions of 12 four or five times

1

4.5 (minutes) / 4 ½ 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*

[2 marks]

Mark scheme 03

(a) **X** = 2800 / 52

1

53.846153

1

54 (cm^3)

Allow correct rounding of an incorrectly calculated value of stroke volume

1

*An answer of 54 (cm^3) scores **3** marks*

(b)

	Mark
Level 3: Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5-6
Level 2: Relevant points (reasons / causes) 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:

Effect of exercise

- During exercise body needs to transfer (more) energy.
- Energy transferred during respiration.
- Rate of respiration increases during exercise.
- (So) more oxygen is needed.

Effect of beta blockers

- Beta blockers reduce (the increase in) heart rate (during exercise).
- Beta blockers reduce stroke volume (or described).
- Beta blockers reduce cardiac output.
- (So) heart cannot supply oxygen fast enough / in sufficient quantity to muscle cells.

Effect on breathing rate

- Breathing rate increases to increase rate / amount of oxygen absorbed.
- Breathing rate increases to increase rate / amount of carbon dioxide removed from body.
- (But) increased breathing rate cannot fully compensate for changes in heart function.

A **Level 3** response should make links between all three sections of indicative content.

A **Level 2** response should attempt to link effect of exercise with oxygen / energy requirement **and** beta blockers to effect on heart function.

6

[9 marks]

Mark scheme 04

Any **three** from:

- Increased energy intake if more food eaten
  Allow increased energy intake if more fat / carbohydrate eaten
  Allow converse
  Allow energy taken in when you eat
- If exercise more, more energy is transferred / released
  *Allow if exercise more, respiration / metabolism increases **or** is faster*
  Allow converse
  Allow energy is transferred during exercise
  *Do **not** accept energy is burnt during exercise*
- If more energy is taken in than is transferred body mass increases
  or
  If less energy is taken in than is transferred body mass decreases
  Allow if less energy is transferred than is taken in body mass increases
  or
  If more energy is transferred than is taken in body mass decreases
- If energy intake = energy transferred body mass stays the same

*If no marks are awarded allow **1** mark for food eaten can increase body mass **and** exercise can decrease body mass*
or
*Allow **1** mark for if a lot of food is eaten **and** little exercise is done body mass increases*
Allow converse

*Max **2** marks if refer to energy being made / used / produced / created*
Allow reference to calories / joules for energy

[3 marks]

Mark scheme 05

C. $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

[1 mark]

Mark scheme 06.1

Measure the volume of oxygen produced in a given time

or

When more oxygen is produced in a given time the rate of photosynthesis is faster

Allow when oxygen is produced faster the rate of photosynthesis is faster
Ignore the faster the rate of photosynthesis, the more oxygen is produced

Allow the slower the oxygen is produced the slower the rate of photosynthesis
or
Less oxygen being produced in a given time, the slower the rate of photosynthesis

A reference to rate is needed
Allow gas for oxygen

[1 mark]

Mark scheme 06.2

(a) 20 000 (lux)

Allow answers in range 19 500 to 20 500 (lux)

1

(b) There is a cost for heating the greenhouse

1

There is a cost for increasing the carbon dioxide in the atmosphere (of the greenhouse)

Allow there is a cost for lighting (in winter)

1

(Therefore) the additional costs might exceed the (additional) sale price / profit

or

(Additional) costs could not be recovered by increasing the sale price of the tomatoes

Ignore these additional costs would reduce profits unqualified

1

[4 marks]

Mark scheme 06.3

When there is no light there is no photosynthesis

1

(So) no oxygen is produced

1

(But) respiration happens (all the time) and oxygen is used

1

(Therefore) the net / overall oxygen production is negative / - 2 (arbitrary units)

*Do **not** accept an answer of -2 (arbitrary units) unqualified*

1

[4 marks]

Mark scheme 07

Starch (stores) have been converted to glucose

Ignore reference to residual glucose from previous photosynthesis

1

(So the glucose can be) used for respiration / (named) metabolic reactions

or (so the glucose can be) used to release energy

*Do **not** accept idea of energy being produced / created / made*

1

(Because) there is no light to make (new / more) glucose by photosynthesis

1

[3 marks]

Mark scheme 08

Reduced / no enzyme production / release (from pancreas)

Allow named example of enzymes

Ignore reference to hormones

1

Food is not broken down fully **or** food is not digested fully

Allow no food is broken down / digested

Allow example

1

Plus any **one** of the following routes for max **2** marks:

Mark as pairs

Less glucose / sugar absorbed **or** less glucose / sugar passes into the blood(stream)

1

(So) less glucose available for respiration so more (body / stored) fat used up in metabolism / respiration

1

or

Fewer amino acids absorbed **or** fewer amino acids pass into the blood(stream) (1)

(So) fewer amino acids are available for making new protein for repair / replacement (1)

or

Fewer fatty acids absorbed **or** fewer fatty acids pass into the blood(stream) (1)

Ignore glycerol

(So) fewer fatty acids available so less fat is stored in the body (1)

Ignore glycerol

or

Chemotherapy / radiotherapy causes nausea / loss of appetite (1)

(So) less intake of food (1)

[4 marks]

Mark scheme 09

Concentration gradient (of oxygen) is shallow(er) / less steep

1

(Therefore) less oxygen diffuses into blood / cells / gills

1

Allow idea that concentration gradient is negative (i.e. out of axolotl) (1)

So oxygen diffuses out of axolotl's blood / cells / gills (1)

(So) less (aerobic) respiration occurs so less energy is released / available

or

(So more) anaerobic respiration occurs so less energy is released / available

*Do **not** accept no respiration occurs*

*Do **not** accept energy production*

1

(So) less metabolism

Ignore reduced living processes unqualified

*Allow reduction of building larger molecules **or** movement / muscle contraction **or** keeping warm **or** urea formation **or** chemical reactions*

or

(So when) anaerobic respiration occurs, lactic acid is produced (and is toxic)

1

[4 marks]