

MARK SCHEME

GCSE

BIOLOGY

AQA - COMBINED SCIENCE

B 4 - TEST 6
BIOENERGETICS
Advanced

Mark schemes

- 1.** carbon dioxide concentration 1
- since atmospheric concentration very low / value give e.g. 0.03%
allow carbon dioxide used up 1
- temperature high
allow if light chosen as a factor 1
- light intensity high
allow if temperature chosen as a factor 1
- [4]**
- 2.** (a) low in winter / named months / when the days are short
accept increases in spring / Dec – June 1
- high in summer / named month(s) / (when days are long
decreases in autumn / June – December 1
- reasonable quantitative statement
accept any reasonable calculated / translated quantitative statement
higher in summer than in winter for 2 marks
comparative statements may be worth 2 marks
but
8/11 times higher in summer than in winter for 3 marks 1
- (b) no artificial light given in summer / light only given in winter
- since natural light greatly exceeds minimum / 600 J (required to produce tomatoes)
accept day length if linked to light energy

OR

light only given in winter

as natural light less than the minimum
needed (to grow them) or 600 J

OR

for 2 marks:

percentage increase in growth from artificial] light only significant in winter

2

[5]

3.

- (a) 7.15 to 7.45 am **and** 7.15 to 7.45 pm
both required, either order
accept in 24 hr clock mode

1

- (b) (i) 11

1

- (ii) 32.5 to 33
allow answer to (b)(i) + 21.5 to 22

1

- (c) any **two** from:

- more photosynthesis than respiration
- more biomass / carbohydrate made than used
allow more food made than used
- so plant able to grow / flower
accept plant able to store food

2

[5]

4.

- (a) light is trapped / absorbed / used
extra answers cancel mark
ignore solar / sunshine

1

by chlorophyll / chloroplasts

*if no other marks awarded, allow 1 mark for photosynthesis /
equation for photosynthesis*

1

- (b) (to make) starch (for storage)
ignore 'for growth' unqualified
ignore respiration

1

(to make) fat / oil (for storage)

1

(to make) amino acids / proteins / enzymes

1

(to make) cellulose / cell walls

allow for active transport

allow any other correct, named organic substances (eg DNA / ATP / chlorophyll / hormone)

*if no named examples, allow 'to make **named** cell structures' for max. 1 mark*

1

[6]

5.

(a) LHS: carbon dioxide **AND** water

in either order

*accept CO_2 **and** H_2O*

allow CO_2 and H_2O

if names given ignore symbols

*do **not** accept CO^2 / H^2O / Co / CO*

ignore balancing

1

RHS: sugar(s) / glucose / starch / carbohydrate(s)

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

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

*do **not** accept $\text{C}^6\text{H}^{12}\text{O}^6$*

1

(b) (i) light is needed for photosynthesis

or

no photosynthesis occurred (so no oxygen produced)

1

(ii) oxygen is needed / used for (aerobic) respiration

full statement

*respiration occurs **or** oxygen is needed for anaerobic respiration
gains 1 mark*

2

(c) (i) (with increasing temperature) rise then fall in rate

1

use of figures, ie

max. production at 40 °C

or maximum rate of 37.5 to 38

1

(ii) 25 – 35 °C

either faster movement of particles / molecules / more collisions
or particles have more energy / enzymes have more energy

1

or temperature is a limiting factor over this range

40 – 50 °C

denaturation of proteins / enzymes

ignore denaturation of cells

ignore stomata

1

(d) above 35 °C (to 40 °C) – little increase in rate
or > 40 °C – causes decrease in rate

1

so waste of money **or** less profit / expensive

1

because respiration rate is higher at > 35 °C

or

respiration reduces the effect of photosynthesis

1

[12]

6.



correct reactants

1

correct products

1

(b) correct scale and label on x axis

1

all 5 plots correct

tolerance $\pm\frac{1}{2}$ small square

allow 2 or 3 plots correct for 1 mark

2

(c) no

no mark

although as distance increases, rate decreases

1

the line curves **or** line should be straight

1

suitable data quoted

examples:

- *supports conclusion between 20–40 (cm)*
- *does not support conclusion between 10–20 (cm)*

1

(d) volume of 1 bubble = $\frac{4}{3} \times 3.14 \times (0.1)^3$

1

= 0.00419

1

at 40 cm there are 7 bubbles

1

vol at 40 cm = 0.02933

allow ecf from incorrect value taken from table

1

Rate per minute = $\times 2$

= 5.86×10^{-2} (cm³ per min)

allow 5.86×10^{-2} with no working shown for 5 marks

1

*answer not given in standard form or to incorrect number of sig. figs
max 4 marks*

[13]

7.

(a) LHS – carbon dioxide / CO_2

allow CO2

ignore CO^2

1

RHS

in either order

glucose / carbohydrate / sugar

allow starch

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

ignore $\text{C}^6\text{H}^{12}\text{O}^6$

1

oxygen

allow O_2 / O_2

ignore O^2 / O

1

(b) any **five** from:

- factor 1: CO₂ (concentration)
- effect - as CO₂ increases so does rate and then it levels off or shown in a graph
- explanation:
(graph increases) because CO₂ is the raw material or used in photosynthesis / converted to organic substance / named eg
or
(graph levels off) when another factor limits the rate.
accept points made via an annotated / labelled graph
- factor 2: temperature
allow warmth / heat
- effect – as temperature increases, so does the rate and then it decreases or shown in a graph
allow 'it peaks' for description of both phases
- explanation:
(rise in temp) increases rate of chemical reactions / more kinetic energy
allow molecules move faster / more collisions
or
(decreases) because the enzyme is denatured.
context must be clear = high temperature

*allow other factor plus effect plus explanation:
eg light wavelength / colour / pigments / chlorophyll / pH / minerals / ions / nutrients / size of leaves
2nd or 3rd mark can be gained from correct description and explanation*

5

[8]

8.

(a) *idea*
O₂ increases
CO₂ decreases

for 1 mark each

2

(b) (i) *ideas that*

- energy transferred faster in 100m race
(*not* more energy transferred)
- carbon dioxide produced faster during 1500m race
for 1 mark each

(*allow* more carbon dioxide produced)

correct reference to twice / half as fast in either / both cases
for 1 further mark

3

- (ii)
- respiration during 100m race (mainly) anaerobic
 - respiration during 1500m race aerobic
 - aerobic respiration produces carbon dioxide
 - anaerobic respiration doesn't produce carbon dioxide
/ produces lactic acid
any two for 1 mark each

2

(c) *ideas that*

- there is an oxygen debt / more than normal oxygen needed
- lactic acid needs to be oxidised / combined with oxygen
for 1 mark each

2

[10]