

Photosynthesis

Mark Scheme 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Biology
Exam Board	AQA
Topic	4.4 Bioenergetics
Sub-Topic	Photosynthesis
Difficulty Level	Gold Level
Booklet	Mark Scheme 1

Time Allowed: 60 minutes

Score: /59

Percentage: /100

Grade Boundaries:

M1.(a) control

1

to check that the indicator colour does not change on its own

or

to check any changes in colour are due to the organisms

1

(b) (tube) E

1

most carbon dioxide

1

(due to) only respiration occurring

allow no carbon dioxide used for photosynthesis

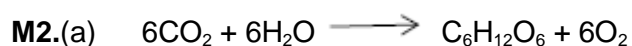
*allow 1 mark **max** if chose tube D and give a correct reason*

1

(c) the amount of carbon dioxide produced by respiration equalled amount absorbed for photosynthesis

1

[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 = $4 / 3 \times 3.14 \times (0.1)^3$

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]

M3.(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]

M4.(a) use of quadrat / point frame

allow description

1

randomly placed / random sampling
ignore reference to transects

1

(b) (i) 6

1

- (ii) more light in A / in field / where sunny
ignore sun

1

more / better / faster photosynthesis in A / with more light
allow converse

1

- (iii) use light meter / measure light intensity in both habitats

1

take many measurements at same time of the day

1

or

laboratory / field investigation with 2 batches high light and low light (1)

count or number of flowers in each (1)

counting point is dependent on investigation point

- (c) more glucose / energy available
allow other named product eg protein
allow if more energy produced

1

for growth

dependent on 1st mark

1

[9]

M5.(a) LHS – carbon dioxide / CO₂

allow CO₂

ignore CO²

1

RHS

in either order

glucose / carbohydrate / sugar

allow starch

allow $C_6H_{12}O_6$ / $C_6H_{12}O_6$

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

1

oxygen

allow O_2 / O_2

ignore O^2 / O

1

(b) any **five** from:

- factor 1: CO_2 (concentration)
- effect - as CO_2 increases so does rate and then it levels off or shown in a graph
- explanation:(graph increases) because CO_2 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]

- M6.** (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]

M7. (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]