



Mark schemes

Q1.

- (a) $6\text{O}_2 + \text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 6\text{H}_2\text{O} + 6\text{CO}_2$ 1
- (b) mitochondria / mitochondrion 1
- (c) any **two** from:
- movement / muscle contraction
 - keeping warm
 - active transport
 - building larger molecules
- ignore reference to metabolism
unqualified
allow examples of movement
allow examples of building larger
molecules e.g. making (named) proteins
/ cellulose
allow cell division
ignore growth*
- 2
- (d) any **two** from:
- anaerobic produces lactic acid **and** aerobic does not
*allow anaerobic creates an oxygen debt
and aerobic does not*
 - aerobic produces carbon dioxide **and** anaerobic does not
 - aerobic produces water **and** anaerobic does not
 - aerobic occurs (mainly) in the mitochondria **and** anaerobic does not
*allow anaerobic **only** occurs in the
cytoplasm*
 - anaerobic releases less energy than aerobic
*allow anaerobic releases less ATP
(than anaerobic)
do **not** accept anaerobic produces /
makes / creates less energy*
- 2
- (e) carbon dioxide 1
- ethanol 1
- (f) pondweed takes in CO_2 for photosynthesis 1
- snail **and** pondweed are respiring producing CO_2



if no other mark awarded allow rate of respiration = rate of photosynthesis for 1 mark

1

- (g) (no light so) no photosynthesis
or
plant is not taking in CO₂

and

snail **and** plant are respiring and so are releasing CO₂

1

- (h) snail is being decayed / decomposed / broken down
ignore being fed on

1

(by) decomposers / bacteria (in pond water / snail)
allow fungi / microbes / microorganisms

1

(therefore) respiration (of decomposers / bacteria) releases CO₂
*do **not** accept anaerobic respiration*

1

[14]

Q2.

- (a)

Factor	Biotic	Abiotic
Nitrates in the soil		✓
Rabbits eating the plants	✓	
Shading by a building		✓
Soil pH		✓
Temperature		✓
Trampling by people	✓	

all 6 correct = **3** marks
4 or 5 correct = **2** marks
2 or 3 correct = **1** mark
0 or 1 correct = **0** marks

3

- (b) (grid and) coordinates

1



- to achieve randomness
ignore throwing quadrat
allow random coordinates for 2 marks
if no other mark awarded allow random walk or description of random walk for 1 mark
- 1
- (c) (mean per m^2 =)
 24 or 6×4
- 1
- (calculation of area of lawn =) ($\frac{1}{2} \times 16 \times 10$) – (6×3)
 or $80 - 18$
- 1
- (area of lawn =) $62 m^2$
allow correct calculation using total area (of triangle) – area of rectangle
- (total number of daisies =)
 24 x 62
allow correct calculation using an incorrectly calculated area of the lawn and / or mean
- 1
- 1488
allow answer based on incorrect area
- 1
- (answer to 3 sig figs =) 1490
allow student's calculated answer rounded to 3 sig figs
- 1
- (d) too few quadrats or quadrat too small
allow sample size too small
- 1
- sample may not be representative of the lawn
allow quadrats may not have been placed randomly
- 1
- [13]**

Q3.

- (a) before arrow
 carbon dioxide **and** water
allow correct chemical symbols
ignore any attempt at balancing equation
ignore light / chlorophyll



either order

1

after arrow

glucose

*ignore sugar / carbohydrate
do **not** accept starch*

1

(b) light

*ignore description of subsequent parts of the
photosynthesis reaction*

allow sunlight

ignore sun

1

(light) is captured / trapped / absorbed by chlorophyll / chloroplasts

allow (light) is used by chlorophyll / chloroplasts

1

(c)

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

or

$$\frac{57.3}{3}$$

1

19.1 (cm³/hour)

*allow an answer correctly calculated using only two
correct values*

1

(d) a ring around 14.2

allow clear indication of correct result

1

(e) any **one** from:

- scale / value was misread
*ignore human error
ignore references to counting bubbles or time
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
- 1
- (f) did not use it in calculation (of mean)
- 1
- (g) any **one** from:
- light (intensity)
 - do **not** accept temperature*
 - ignore time*
 - allow distance / power / colour of lamp / light*
 - carbon dioxide (concentration)
 - pondweed size / amount
 - pondweed species
 - allow same (piece of) pondweed*
- 1
- (h) enzyme(s) lose the shape of the active site
 - allow enzyme(s) (start to) denature*
 - allow enzyme(s) destroyed / damaged*
 - do **not** accept enzyme(s) killed*
- 1
- (i) y-axis labelled '(rate of) photosynthesis in cm³/hour'
- 1
- suitable scale on y-axis
 - must take up half or more of grid provided*
- 1
- all points plotted to within $\pm \frac{1}{2}$ small square
 - allow 3 or 4 correct plots for 1 mark*
 - ignore any attempt to plot a point at 20 °C*
- 2
- correct curved line of best fit
 - ignore line joined point to point with straight lines*
 - ignore extrapolation*
- 1
- [16]**
- Q4.**
- (a) fatty acids
- 1



- glycerol 1
- (b) enzyme binds to the substrate because they are complementary (shapes) 1
allow enzyme joins to the substrate because they fit together exactly
allow enzyme joins to the substrate because the substrate fits the active site
*ignore reference to specificity do **not** accept same shape*
- (so) substrate is broken down (into products) 1
allow (so) substrate splits (into products)
ignore products are formed, unqualified
- (so) products are released **or** enzyme is not changed 1
allow enzyme is not used up
*allow reference to activation energy for either marking point 2 **or** marking point 3*
- (c) each active site has a specific shape (so only fits one type of lipid molecule) 1
allow each active site is a different shape
*do **not** accept reference to the substrate having an active site*
- (d) add Benedict's (solution / reagent to the liquid) 1
- boil / heat 1
allow any temperature of 65 °C or above
- (if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick) red 1
- (e) add iodine solution / reagent (to the liquid) 1
allow add a drop of iodine
ignore iodine unqualified
- (if starch is present) it changes colour to blue / black (from yellow / orange / brown) 1



- (f) glucose from photosynthesis
*do **not** accept starch made in photosynthesis* 1
- (excess) glucose converted to starch
allow (excess) glucose is stored as starch 1
- (g) 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
- (h) any **one** from:
 • test roots / stems of plants (in the light and dark)
*do **not** accept reference to changing the independent variable*
allow test other parts of the plants
 • test other species of plant
allow test other types of plant
 • measure the concentrations of glucose **and** starch
ignore mass / amount
 • vary the time in the dark / light
 • test variegated leaves
allow any other valid extension ignore repeats 1
- [17]

Q5.

- (a) *words take precedence over symbols*
- LHS: 1
- carbon dioxide **and** water
- RHS:
 glucose 1



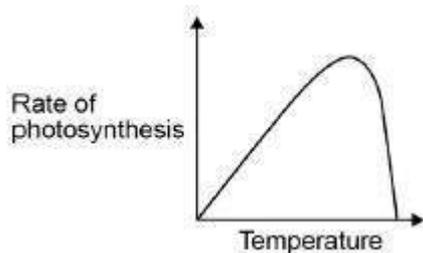
- allow correct symbols (ignore balancing)*
in any order
*do **not** accept starch*
ignore carbohydrates / sugar
- (b) power output of bulb 1
- (c) any **two** from:
- repeat **and** calculate a mean
or
repeat **and** to eliminate anomalies
ignore do a control experiment unqualified
 - control the (water) temperature
allow a method of controlling (water) temperature
 - control the concentration of carbon dioxide
allow a method of controlling carbon dioxide concentration
 - control the distance of the bulb from the pondweed
 - control the mass / length / species / age of the pondweed
allow use the same piece of pondweed
 - give pondweed time to equilibrate
allow do experiment with the bulb off / in the dark
- 2
- (d) 3.3 (cm³/hour) 1
- (e)
- max **3** marks for bar chart*
- correct scale **and** axis labelled 1
- all points plotted correctly
allow points plotted to within $\pm \frac{1}{2}$ small square
*allow 3 or 4 correct plots for **1** mark*
allow correct plot from incorrect value calculated in part (d) 2
- correct curved line of best fit
ignore line extended beyond 60 / 250 (W)
ignore line joined point to point with straight lines 1
- (f) correct answer from their line drawn on **Figure 2**
allow $\pm \frac{1}{2}$ small square tolerance



allow 1.8 / 1.9 if no line of best fit or incorrect graph is drawn

1

(g)



1

[12]

Q6.

- (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

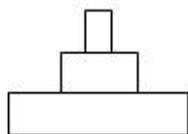
bars plotted correctly
all 4 correct = 2 marks 3 correct = 1 mark



	<i>if wrong type of graph drawn, max 2 marks</i>	2
(h)	blue light gives highest (rate of) photosynthesis <i>allow ecf from candidate's graph allow blue light is best</i>	1
	green light gives the lowest (rate of) photosynthesis <i>allow green light is worst</i>	1
(i)	energy <i>in this order only</i>	1
	cell wall(s) <i>allow cell</i> <i>do not accept (cell) membrane</i>	1
	starch / fat / oil / lipid	1
		[14]

Q7.

(a)	correct figures from graph: 5.0 / 5 and 2.60 / 2.6 2.40 / 2.4 <i>an answer of 2.40 / 2.4 scores 2 marks</i>	1
	<i>allow correct answer from candidate's figures from graph for 1 mark</i>	1
(b)	$\frac{1}{3}$	1
(c)	protein	1
(d)	a genetically-modified variety of seed was sown in 2004	1
	more rain fell in spring and early summer in 2004	1
	the mean summer temperature was lower in 2003	1



(e) 1

(f) 80 1

(g) chickens use energy for movement and for keeping warm 1

much of the food eaten by chickens is wasted as faeces 1

[11]

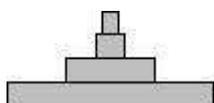
Q8.

(a) carbon dioxide 1

water 1

(b) light 1

(c) 1



(d) 2.3 and 0.5 1

*allow figures in millions
allow in range 2.25 to 2.3 for 2.3
allow in range 0.5 to 0.55 for 0.5*

$$\frac{(2.3 - 0.5) \times 100}{2.3} \text{ or } \frac{1.8 \times 100}{2.3}$$

*allow correct substitution of student's
incorrect graph readings* 1

78.2(6087....) 1

*allow correct answer from student's
substitution of incorrect graph readings
ignore incorrect rounding*

78 1

*allow correct rounding of calculated
value*



- (e) increase (in biomass of herring) 1
- from 0.1 to 1.8 (million tonnes)
or
 change of 1.7 (million tonnes)
or
 change of 1700%
- allow a tolerance of $\pm \frac{1}{2}$ small square
 for graph readings* 1
- (f) smaller / 4-yr-old fish not caught 1
- allow younger fish not caught
 allow (only) older fish caught*
- (so) escaping fish can reproduce 1
- allow so younger fish can survive to
 reproduce* 1
- [12]**

Q9.

- (a) will stop animals / herbivores eating it 1
- allow it will not be eaten*
- (b) chemical 1
- (c) thorns / spikes / spines / prickles (to stop animals / herbivores eating it) 1
- (d) for respiration 1
- to store as starch 1
- (e) add Benedict's (solution / reagent to the liquid) 1
- boil / heat 1
- allow any temperature of 65 °C or
 above*
- (if glucose is present the blue) colour changes to yellow / green /
 orange / brown / (brick) red 1
- (f) (nitrate ions are needed) to make proteins / amino acids 1
- allow to make chlorophyll / DNA / ATP /*



	<i>nucleic acid</i>	1
	which are needed for growth / enzymes / new cells <i>allow correct process for named molecule in mp1</i>	1
(g)	in / on the (soil) water <i>allow through air (spaces) in the soil</i>	1
(h)	dosage	1
	toxicity	1
(i)	placebos	1
		[14]

Q10.

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 apply a 'best-fit' approach to the marking.

Level 3 (5–6 marks):

A description of how the apparatus is used to measure the **rate** of photosynthesis at different light **intensities** is given.

For full marks reference must be made to a control variable

or

repeats

Level 2 (3–4 marks):

A description of how the apparatus is set up

and

a description of how photosynthesis can be measured.

or

a description of how light intensity is varied

or

a control variable **or** any other relevant point

Level 1 (1–2 marks):

A partial description of how the apparatus is set up

or

a description of how light is supplied

or

a simple description of how photosynthesis can be measured.

or

a control variable

0 marks:



No relevant content.

examples of the points made in the response:

- apparatus set up:
 - weed in water in beaker
 - light shining on beaker
- method of varying the light intensity—eg changing distance of lamp from plant
- method of controlling other variables
 - use same pond weed **or** same length of pond weed
 - temperature: water bath or heat screen
 - CO₂
- leave sufficient time at each new light intensity before measurements taken
- method of measuring photosynthesis – eg counting bubbles of gas released or collecting gas and measuring volume in a syringe
- measuring **rate of photosynthesis** by counting bubbles for set period of time
- repetitions

extra information:

allow information in the form of a diagram

[6]