

Mark schemes

Q1.

- (a)  $6O_2 + C_6H_{12}O_6 \rightarrow 6H_2O + 6CO_2$  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<sub>2</sub> for photosynthesis 1
- snail and pondweed are respiring producing CO<sub>2</sub>

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

- (g) (no light so) no photosynthesis  
or  
plant is not taking in CO<sub>2</sub>  
and  
snail and plant are respiring and so are releasing CO<sub>2</sub> 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 CO<sub>2</sub>  
*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<sup>2</sup> =)  
24 or  $6 \times 4$*

1

*(calculation of area of lawn =)  $(\frac{1}{2} \times 16 \times 10) - (6 \times 3)$   
or  $80 - 18$*

1

*(area of lawn =) 62 m<sup>2</sup>*

*allow correct calculation using total area  
(of triangle) - area of rectangle*

*(total number of daisies =)*

*24 × 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 (cm<sup>3</sup>/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 cm<sup>3</sup>/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)  
*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* 1
- (so) substrate is broken down (into products)  
*allow (so) substrate splits (into products)*  
*ignore products are formed, unqualified* 1
- (so) products are released or enzyme is not changed  
*allow enzyme is not used up allow reference to activation energy for either marking point 2 or marking point 3* 1
- (c) each active site has a specific shape (so only fits one type of lipid molecule)  
*allow each active site is a different shape*  
*do not accept reference to the substrate having an active site* 1
- (d) add Benedict's (solution / reagent to the liquid) 1
- boil / heat  
*allow any temperature of 65 °C or above* 1
- (if glucose is present the blue) colour changes to yellow / green / orange / brown / (brick) red 1
- (e) add iodine solution / reagent (to the liquid)  
*allow add a drop of iodine*  
*ignore iodine unqualified* 1
- (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: 1
- glucose

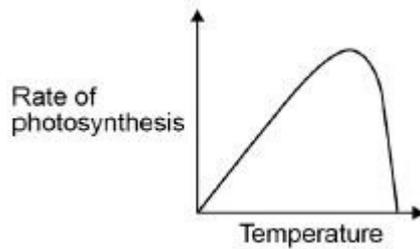
*allow correct symbols (ignore  
balancing)  
in any order  
do not accept starch  
ignore carbohydrates / sugar*

- (b) power output of bulb 1
- (c) any two from:
- repeat and calculate a mean  
or  
d 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 (cm<sup>3</sup>/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

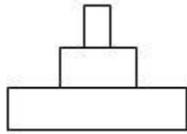
bars plotted correctly

*all 4 correct = 2 marks 3 correct = 1 mark*

- 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
- [14]

Q7.

- (a) correct figures from graph: 5.0 / 5 and 2.60 / 2.6  
 2.40 / 2.4  
*an answer of 2.40 / 2.4 scores 2 marks* 1  
*allow correct answer from candidate's figures from graph for 1 mark* 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]

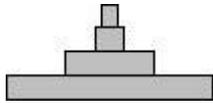
Q8.

(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*

78.2(6087....)

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

78

*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  
*allow younger fish not caught  
allow (only) older fish caught* 1
- (so) escaping fish can reproduce  
*allow so younger fish can survive to  
reproduce* 1
- [12]

Q9.

- (a) will stop animals / herbivores eating it  
*allow it will not be eaten* 1
- (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  
*allow any temperature of 65 °C or  
above* 1  
(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  
*allow to make chlorophyll / DNA / ATP /*

|     |   |            |
|-----|---|------------|
|     | <i>nucleic acid</i>   | 1          |
|     | which are needed for growth / enzymes / new cells<br><i>allow correct process for named molecule in mp1</i> | 1          |
| (g) | in / on the (soil) water<br><i>allow through air (spaces) in the soil</i>                                   | 1          |
| (h) | dosage<br><br>toxicity  | 1<br><br>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 or any other relevant point

~~a description of how light intensity is varied~~

A partial description of how the apparatus is set up  
or  
or  
a control variable  
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
  - CO<sub>2</sub>
- 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]