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_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

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 m2 =)*
24 or 6 × 4

1

(calculation of area of lawn =) (½ × 16 × 10) – (6 × 3)
or 80 – 18

1

(area of lawn =) 62 m2

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^3/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^3/hour'

1

suitable scale on y-axis
must take up half or more of grid provided

1

all points plotted to within ± ½ 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 <u>active site</u> has a specific shape (so only fits one type of lipid molecule)

allow each <u>active site</u> 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:
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 ± ½ 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

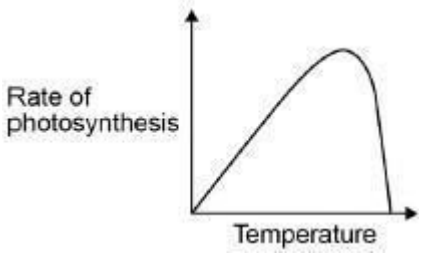
1

(f) correct answer from their line drawn on Figure 2
allow ± ½ 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

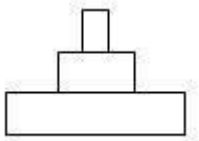
1

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

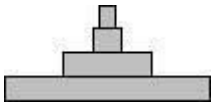
1

water

1

(b) light

1

(c) 

1

(d) 2.3 and 0.5

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

1

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

allow correct substitution of student's incorrect graph readings

1

78.2(6087....)

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

1

78

allow correct rounding of calculated value

1

(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 ± ½ 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 /

nucleic acid

1

which are needed for growth / enzymes / new cells

allow correct process for named molecule in mp1

1

(g) in / on the (soil) water

allow through air (spaces) in the soil

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]