Mark schemes

Q1.

(a) ***Leaf 1 or covered with black paper***
no light so no photosynthesis (occurs)
ignore reference to water
ignore reference to carbon dioxide
1

Leaf 2 or covered with transparent plastic
no carbon dioxide so no photosynthesis
1

Leaf 3 or not covered
light and carbon dioxide present so leaf can photosynthesise
ignore no limiting factors
1

for either Leaf 1 / 2
(so) glucose not made
1

(and therefore) glucose / sugar cannot be converted to starch
*allow converse for **Leaf 3***
*if neither marking points 4 and 5 awarded, allow starch (previously present) has been broken down for **1** mark*
1

(b) (green) starch / present / positive
*allow blue-black / black **or** dark blue*
and
(white) no starch **or** not present **or** negative
allow yellow / orange / brown
*both required for **1** mark*
1

(c) green part contains chlorophyll **and** white part does not
ignore chloroplasts
1

(so) light is absorbed by green part (but not by white part) so photosynthesis occurs and starch can be formed
allow (so) light is absorbed by chlorophyll / chloroplasts so photosynthesis occurs and starch can be formed
allow converse for white part
ignore colours of starch test if referenced
1

(d) magnesium

allow Mg / Mg^{2+}

allow nitrate / iron

allow other correct named ions

1

(e) chlorosis

1

(f) (measure the) <u>volume</u> (of oxygen) released / produced in a given time

or

(count / number of) bubbles released / produced in a given time

allow answers in terms of a specific time

ignore measure the amount (of oxygen) released in a given time

1

(g) (a factor that) if increased would increase the rate (of a reaction)

or

(a factor that) prevents the rate (of a reaction) increasing

allow answers in terms of (a) named factor(s)

allow (a factor that) prevents the maximum rate (of a reaction) being reached

1

(h) increasing temperature while keeping the carbon dioxide (concentration) constant increases the rate (of photosynthesis)

allow increasing the carbon dioxide (concentration) while keeping temperature constant increases the rate (of photosynthesis)

1

increasing the temperature increases the movement of the molecules / particles / substrate

or

increasing the temperature increases the rate of enzyme activity

allow increasing the temperature increases the kinetic energy of the molecules / particles / substrate

allow increasing the temperature increases the frequency of collisions between molecules / particles

1

increasing carbon dioxide concentration increases (the concentration of) substrate / reactants

1

all rates plateau at a certain point due to another factor being limiting

allow all rates plateau at a certain point due to chlorophyll being limiting

*do **not** accept all rates plateau at a certain point due to light being limiting*

1

(i)

light intensity $\propto \frac{1}{\text{distance}^2}$

1

[17]

Q2.

(a) (*lhs)* $H_2O + CO_2$

in either order

and

(*rhs*) O_2

1

(b) from 0 to 5 000 lux

1

(c) any **one** from:

- use (different) coloured bulb(s) / LED(s)
- use (different) coloured filter(s) in front of lamp
- put (different) coloured transparent material(s) over lamp / beaker

allow named transparent material(s)

1

(d) *independent*

colour of light

allow wavelength of light

ignore colour of filter / bulb / lamp

1

dependent

time (taken for 10 leaf discs to reach the surface of the solution)

1

(e) any **one** from:

- so that discs would sink (to the bottom of the beaker)

allow leaf for disc throughout

allow so the discs do not float

- so any gas (that makes the discs rise) is from photosynthesis
- air is a gas so any left in discs would add to the oxygen produced by photosynthesis

ignore reference to carbon dioxide

allow as a control variable

1

(f) (sodium hydrogencarbonate) provides / releases carbon dioxide

ignore (sodium hydrogencarbonate) contains carbon dioxide

ignore provides water

1

(carbon dioxide is used) for photosynthesis

1

(g) oxygen was produced in photosynthesis

1

oxygen / gas is trapped in / around disc / leaf

allow bubbles are trapped in / around the disc / leaf

allow oxygen / gas (makes leaf discs) less dense than solution / water

allow the oxygen / gas under the disc / leaf pushes the disc / leaf up

1

(h) to absorb / use many / more colours / wavelengths of light

allow to increase the rate of photosynthesis

ignore to absorb as much light as possible

*do **not** accept to absorb all colours / wavelengths of light*

1

(i) chlorophyll absorbs most **or** a lot of blue light

1

chlorophyll absorbs least **or** very little **or** not much green light

*if neither mark awarded allow **1** mark for chlorophyll absorbs more blue light (than green light)*

allow chlorophyll reflects most of the green light

1

(so) discs in blue light took the least time to rise (to surface) because they photosynthesised faster / more

or

(so) discs in green light took the most time to rise (to surface) because they photosynthesised slower / less

1

use of data (from **Figure 3** and **Table 2**) eg approximately 80% of blue light absorbed

1

[15]