GCSE
BIOLOGY

Topic Paper: 4.1 Photosynthesis
Part 1 & 2 Mark Scheme

MARK SCHEME

71 Marks

M1. (a) e.g.:
competition for light because potamogeton plants taller
competition for nutrients taller plants may have longer roots
each for 1 mark

4

(b) descriptions of:
measuring tape or similar quadrat
method of estimating cover (inside quadrat)
each for 1 mark

3

[7]

M2. (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]

M3. (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]

M4. (a) (i) oxygen produced

1

(ii) any **one** from:

average / mean / median
ignore reliable / precise / accurate

some may be anomalous
allow some may not float

1

(b) (i) *do **not** allow answers in terms of time only*
*if candidate answers in terms of comparing rate of change then the rate of change of photosynthesis must be in the correct direction for **1** mark*

any **two** from:

low intensity / below 12.5 / 2.5 - 12.5 (units of light) flat wrack /it, rate of photosynthesis faster **or** saw wrack rate of photosynthesis slower
allow any value in range

high intensity / above 12.5 / 12.5 - 15 (units of light) flat wrack / it,rate of photosynthesis slower **or** saw wrack rate of photosynthesis faster
allow any value in range

same (rate) at 12.5 units

2

(ii) any **two** from:

saw wrack receives less light
accept converse if clear reference to bladder wrack

less photosynthesis
if first and second responses, 'less' needed only once

or
less carbohydrate / sugar / starch production

when tide is in **or** at high tide **or** any tide above low tide
accept saw wrack covered by water / submerged longer / more
reference to position on shore is insufficient

2

[6]

M5. (a) (i) to get data re position of seaweed / of organism

1

in relation to distance from sea / distance down shore / how long each seaweed was exposed

1

(ii) repeat several times
minimum = 2 repeats
1

elsewhere along the shore
1

(iii) bladder wrack is further up the shore (than the sea lettuce) / exposed for longer
ignore found in dry areas / on bare rock
1

sea lettuce (only) in rock pools / in the sea / (only) in water
1

(b) gets more light / closer to light
allow better access to CO_2
1

(so) more photosynthesis
allow 1 mark for light for photosynthesis
allow 1 mark for CO_2 for photosynthesis
ignore reference to oxygen for respiration
'more' only needed once for 2 marks
1

[8]

M6. (a) (i) increase (and then level off) **and** max / up to at 0.15 (%) (carbon dioxide)
ignore references to oxygen concentration only
ignore mention of 23
1

(ii) $\underline{CO_2}$ is limiting at low CO_2 / at first
ignore specific numbers
1

light is limiting at high CO_2 / at end
1

(b) ***mark both parts together***

effect: (oxygen) falls
1

explanation: (oxygen) used for respiration
***if no other marks** awarded allow (effect) no change **and** (explanation) no photosynthesis for **1** mark*
1

(c) more chlorophyll / chloroplasts
1

allows more photosynthesis / description
for both marks must refer to more at least once

1

[7]

M7. (a) 7.15 to 7.45 <u>am</u> **and** 7.15 to 7.45 <u>pm</u>
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]

M8. (a) LHS – carbon dioxide / CO_2
allow CO2
ignore CO^2

1

RHS
in either order

glucose / carbohydrate / sugar
allow starch
allow $C_6H_{12}O_6$ */ C6H12O6*
ignore $C^6H^{12}O^6$

1

oxygen
allow O_2 */ O2*
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]

M9. (a) LHS: carbon dioxide **AND** water

in either order
*accept CO_2 **and** H_2O*
allow CO2 and H2O
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 $C_6H_{12}O_6$
allow C6H12O6
*do **not** accept $C^6H^{12}O^6$*

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 ℃
or maximum rate of 37.5 to 38

1

(ii) 25 – 35 ℃

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 ℃

denaturation of proteins / enzymes

ignore denaturation of cells
ignore stomata

1

(d) above 35 ℃ (to 40 ℃) – little increase in rate
or > 40 ℃ – causes decrease in rate

1

so waste of money **or** less profit / expensive

1

because respiration rate is higher at > 35 ℃
or
respiration reduces the effect of photosynthesis

1

[12]