M1. (a) light is trapped / absorbed / used

extra answers cancel mark

ignore solar / sunshine

1

by chlorophyll / chloroplasts

if no other marks awarded, allow 1 mark for photosynthesis / equation for photosynthesis

1

(b) (to make) starch (for storage)

ignore 'for growth' unqualified

ignore respiration

1

(to make) fat / oil (for storage)

1

(to make) amino acids / proteins / enzymes

1

(to make) cellulose / cell walls

allow for active transport

allow any other correct, named organic substances (eg DNA / ATP / chlorophyll / hormone)

*if no named examples, allow 'to make **named** cell structures' for max. 1 mark*

1

[6]

M2. (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]

M3. (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]

M4. (a) 7.15 to 7.45 am **and** 7.15 to 7.45 pm

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]

M5. (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 °C
or maximum rate of 37.5 to 38

1

(ii) <u>25 – 35 °C</u>

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

<u>40 – 50 °C</u>

denaturation of proteins / enzymes

ignore denaturation of cells
ignore stomata

1

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

1

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

1

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

1

[12]

M6. (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]

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M7. (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 <u>used</u> 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]