**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) 25 – 35 °C

**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 °C

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]**