Mark schemes

1

(a) (i) water / H_2O

allow hydrogen oxide

1

oxygen / O_2 / O

allow upper and lower case symbols and superscripts

answers must be in this order

1

(ii) respiration in the plant

allow clear indication of correct response

1

(b) light (: no light) / light intensity

ignore references to the card / covered / uncovered

1

chlorophyll (: no chlorophyll) / chloroplast

*allow leaf colour **or** both green **and** white given*

1

(c) (i) no light (received) **or** it's dark

allow no photosynthesis
*do **not** allow little light / photosynthesis*
ignore sun
apply list principle for other factors

1

(ii) no chlorophyll / chloroplasts (present)

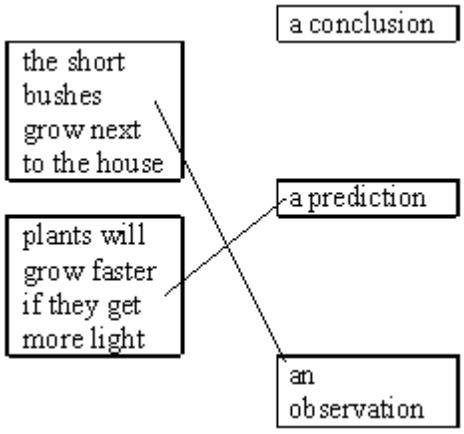
allow no / little photosynthesis
*allow white **or** not green **or** little chlorophyll / few chloroplasts*
apply list principle for other factors

1

[7]

2

(a) (i)



*both correct = **2** marks*
*one correct = **1** mark*
extra line from a statement cancels the mark

2

(ii) 1st space: carbon dioxide

allow CO_2 (ignore superscript)
*do **not** allow CO alone*

1

2nd space: glucose / sugar / starch / carbohydrate

1

(b) (i) any **one** from:

- move lamp or change distance between lamp and plant
  ignore measure the distance
- change wattage / power of (light) bulb
  *do **not** accept just "change bulb"*
- change voltage / power supply to the (light) bulb
- change the number of lamps
- put translucent material between lamp and plant
  accept examples, eg tracing paper / filters
  *do **not** accept coloured filters*

1

(ii) rises

1

levels off

ignore numbers

1

(iii) idea that it levels off

or

does not increase at all light intensities

or

it only increases to a certain amount

*answers should relate to photosynthesis and **not** to bubbling*

1

[8]

3

(a) photosynthesis

1

(b) oxygen

1

(c) chlorophyll

1

(d) starch

1

[4]

4

(a) any **three** from:

- ((mean) mass) increases up to 7 / 8 units (of light) then levels off
- light limiting factor up to 7 / 8 units
- for photosynthesis

  must be in correct context
- other factor / temperature limiting above 7 / 8 units

3

(b) any **two** from:

- cost of providing conditions / heat / light / CO_2
- effect of treatment on profit
  allow too much of factor is wasteful
- relevant use of data from graph eg limiting factors
- named other factors eg fertiliser / pest control / weeds / density of planting
  allow taste / appearance

2

(c) **nitrate function**

produce amino acids / proteins / enzymes
ignore DNA
*do **not** allow chlorophyll*

1

nitrate deficiency

stunted growth
allow description
ignore plant dies

1

magnesium function

produce chlorophyll
ignore chloroplasts

1

magnesium deficiency

yellow leaves / plant
ignore plant dies

1

[9]

5 (a) (i) L.H.S. – water / H_2O

1

R.H.S. – oxygen / O_2
accept H^2O
accept O^2 / O

1

(ii) chlorophyll

must make it clear that it is the chlorophyll
*do **not** credit chloroplast on its own*
*do **not** accept chloroplast / chlorophyll*
without indication that it is chlorophyll

1

(b) (i) light intensity / temperature is high enough for higher rate or light / temperature is not limiting

1

low CO_2 available or not enough CO_2 available **or** rate would be higher with more CO_2

1

(ii) temperature

allow water / rain
allow (too) cold / hot as a minimum
allow wave length / frequency / colour
ignore ions
ignore heat

1

[6]

6 (a) burning fossil fuels / coal / gas / oil

accept driving <u>vehicles</u> / eg cars
accept coal-fired power station
accept car emissions
ignore combustion unqualified
*do **not** accept power station unqualified*
*do **not** accept <u>using</u> fossil fuels*

1

(b) (i) (SO_2) makes it acidic / makes acid rain / lowers pH

1

(ii) any **one** from:

(SO_2) kills leaves reduces number of leaves reduces leaf area
or smaller leaves causes fewer leaves to grow
ignore correct extras, eg
withered, yellow etc

1

(c) any **two** from:

(fewer leaves / less leaf S.A) so less photosynthesis

less food / less sugar / less starch supplied (to roots / to stems)

(SO_2) lowers pH of soil / makes soil acidic

ions (/minerals / salts / nutrients) less available (to plants)

accept don't get enough nutrients

2

[5]

7 (a) carbon dioxide/CO_2

1

(b) through the roots/root hairs

*do **not** accept leaves*

1

(c) oxygen

1

sugar/glucose/other named sugar/starch/carbohydrate

1

(d) award one mark for each mark point

n.b. accept chloroplast for chlorophyll

*n.b. credit the candidate who answers **in** terms of the white areas of the leaf*

chlorophyll is green

e.g. green areas have chlorophyll

1

chlorophyll/green is needed for photosynthesis

e.g. it is only in green areas that photosynthesis can take place

after this point do not penalise a candidate if they do not refer to photosynthesis

1

light is needed

e.g. it does not happen in the dark

*do **not** accept sunshine/sun*

1

photosynthesis produces/makes starch

e.g. starch is made

so

e.g. 'you need light to make starch' scores 3rd and 4th marking points

'you need chlorophyll and light for photosynthesis' scores on the 2nd and 3rd marking points

'photosynthesis makes starch and you need green leaves and light for it to work' scores

on the 2nd, 3rd and 4th marking points

1

[8]

8 (a) water [1]

oxygen [1]

(sun) light or solar [1]

*do **not** accept sun's*

chlorophyll [1]

*do **not** accept chloroplasts*

4

(b) any **two** from:

stored as fructose
stored as sucrose
stored as starch
stored as oil **or** lipid
moved or transported away <u>in the phloem</u>

*do **not** accept "stored" by itself*

respired or burnt up for energy or
fuel changed to protein
changed to cellulose
changed to fructose
changed to starch
changed to oil or lipid

*do **not** accept "food for plant"*
*do **not** accept "used up" by itself*

2

(c) (i) roots or root hair (cells)

1

(ii) the mineral salts are (dissolved) in water [1]

water transports salts throughout the plant
or water enables osmosis or diffusion to take place [1]

2

(d) (i) plants grow better with some nutrients than none
or
plants grow better with nitrates than without

comparison is needed

accept "faster" as equivalent to "better"
accept don't grow well with only water

1

(ii) 0.14(g)

*units **not** needed*

1

(iii) making protein **or** amino acids

*do **not** accept help them grow*

*accept named protein **or** DNA **or** chlorophyll*

1

any **two** from:

(iv) type **or** variety **or** starting weight **or**

2

(iii) size of seedlings

keep the environment the same
*only if light **or** temperature **or** day length not already credited*

light
temperature not heat
time of growth

*do **not** accept the same equipment*
*do **not** accept help them grow*

1

day length
amount of culture solution **or**/size of

accept named protein, DNA chlorophyll

boiling tube
number of seedlings per tube
pH
CO_2
humidity

[15]

9 (a) carbon
water
oxygen

light

chlorophyll

starch

***1** mark each*

6

(b) leaf **(or** named part of leaf)
or
chloroplasts

accept anywhere green

do not credit chlorophyll unless qualified

1

(c) water through the roots
or
root hairs
or
by osmosis

*do **not** credit where the candidate is unclear about which is which*

1

CO_2 through the leaf
or
stomata
or
by diffusion

1

(d) any **one** point:

increased CO_2 concentration
increased water supply
increased temperature (up to a point)
increased light (intensity)

*accept altered light quality by less green **or** increasing other colours*
accept increased duration of exposure to light
*do **not** credit sun **or** sunshine*
accept CO_2 from respiration

1

[10]

10 (a) (i) light **or** solar

*do **not** credit sun's energy*
*do **not** credit radiant*

1

(ii) chlorophyll

1

(iii) chloroplast

1

(iv) CO_2 **+** H_2O

reactants identified (accept words)

1

$C_6H_{12}O_6 + O_2$

products identified (accept words)

1

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

balanced equation

1

(b) any **two** from:

increased CO_2 concentration

increased water supply

increased temperature (up to a point)
increased light intensity

*do **not** accept heat or warmth*

altered light quality by less green **or** increasing other colours

2

(c) any **four** points

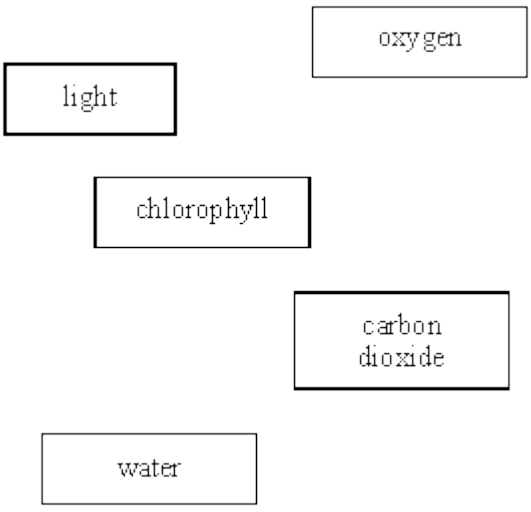
- palisade (mesophyll)
- lots of chloroplasts **or** chlorophyll **or** main site for photosynthesis **or** absorb maximum amount of light
- guard cells
- CO_2 in **or** O_2 out **or** water vapour out
- controls size of stoma **or** pores in leaf

***allow** stomata*

4

[12]

11 (a)



5

(b) (i) sugar **or** carbohydrate

1

(ii) it can be stored **or** it is insoluble

accept it has no osmotic effect

1

(iii) any **one** from:
respires it **or** releases **or** transfers energy
turns it **or** stores it as fructose **or** sucrose **or** lipid **or** protein **or** cellulose

1

(c) (i) photosynthesis

1

(ii) any **one** from:
flat surface
stomata
thin
chloroplasts
veins
large surface area
air spaces

*do **not** accept chlorophyll*

1

[10]

12 (a) reactants: $CO_2 + H_2O$

1

products: $C_6H_{12}O_6 + O_2$

1

balance:

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

1

(b) **1** mark each for any of the following ideas:

lower CO_2 concentration

lower light intensity

decrease water availability

alter light wavelength **or** colour

accept more green light

2

(c) (i) scales correctly constructed

i.e. equal intervals along each axis

1

points plotted correctly

1

appropriate line correctly drawn

*accept dot to dot **or** line of best fit*

cancel if line extends through zero or beyond 50°C

1

(ii) 18 – 19 (bubbles per minute)

1

(iii) heat denatures enzymes **or** destroys membranes **or** ruptures cells **or** destroys cells

do not accept kills enzymes

1

[10]

13 Does not contain chlorophyll which is needed to absorb light **or** energy

each for 1 mark

[2]

14 (a) (i) e.g. mussels/caddis loach

for 1 mark

1

(ii) 3 of:
carbon dioxide
water
chlorophyll/chloroplasts
light
any 3 for 1 mark each

3

(b) 6 of e.g.
some plant/animal material not digested by consumers passes out with faeces
respiration releases energy used in movement lost as heat
some 'lower' organisms die energy transferred to decomposers/detritivores
thence to environment
any 6 for 1 mark each

6

[10]

15 (a) carbon dioxide
oxygen

2

(b) (i) e.g. rubber plant/fern

1

(ii) because can tolerate low light levels

1

(iii) yellow parts of leaf do not contain chlorophyll therefore more light needed for photosynthesis

2

(iv) no leaves/only have stem only have small area which can photosynthesise

2

[8]

16 (a) (i) June
for 1 mark

1

(ii) April
max. light
photosynthesis makes sugars/substances needed for growth
for 1 mark each

3

(b) 2 of:
temperature
carbon dioxide availability
water
chlorophyll

any 2 for 1 mark each

2

[6]

17 (a) Sun / sunlight / light

for 1 mark

1

(b) (i) 21.5 – 22 ***and*** 27 – 27.5

for 1 mark

1

(ii) ideas of limiting factor / shortage of
e.g. light / carbon dioxide / water /chlorophyll

each for 1 mark
(allow 1 for 'maximum' rate of enzyme activity if no reference to limiting factors)
(ignore reference to dematuring)

2

(iii) 21.5 – 22° C

(allow first figure from answer to (i) so that no 'double-penalty' <u>but</u> not below 20)

maximum rate of photosynthesis
(can relate to any number on 'flat')

most economical heating (must relate to left end of 'flat'

each for 1 mark

3

[7]

18 (a) 21.5 – 22 ***and*** 27 – 27.5

for 1 mark

1

(b) *ideas of*
limiting factor / shortage of
e.g. light / carbon dioxide / water / chlorophyll

each for 1 mark
(allow 1 for 'maximum / optimum rate of enzyme activity if no reference to limiting factors) (ignore denaturation)

2

(c) 21.5 – 22° C

*(allow **first** figure from answer to (i) so that no 'double-penalty but only if this first answer is 20 or greater)*

maximum rate of photosynthesis / highest / fastest

but related to flat part of curve

most economical heating / cheapest related to heating

must relate to the temperature the candidate has given

each for 1 mark

3

[6]

19

(a) water / damp / wet
or
suitable temperature / warm / heat / hot
or
light / sun
(*accept* rooting powder / soil qualified e.g. fine / nutrients / fertiliser / minerals)
(*do NOT allow* oxygen / carbon dioxide / food)

for 1 mark

1

(b) *advantage*
quick / cheap / several from one plant / known outcome / same as <u>parent</u>
(*reject* all the same)
disadvantage
<u>all</u> the same / all get same disease

for 1 mark each

2

[3]

20

(a) (i) carbon dioxide / CO_2 (*reject* CO)

(ii) oxygen / O_2 / O (*reject* water vapour)

for 1 mark each

2

(b) (provides) energy

for 1 mark

1

[3]

21 (a) (i) carbon dioxide / CO_2 (*reject* CO)

(ii) oxygen / O_2 / O (water vapour neutral)

for 1 mark each

2

(b) (provides) energy

for one mark

1

(c) starch insoluble therefore water not taken in by osmosis

or

sugar is soluble / has small molecules may diffuse out therefore lost

*(*ignore *ref. to cells bursting)*

or

starch has large molecules

cannot diffuse therefore retained

for 1 mark each

3

[6]

22 (a) low in winter / named months /when the days are short

accept increases in spring / Dec – June

1

high in summer / named month(s) / (when days are long

decreases in autumn / June – December

1

reasonable quantitative statement

accept any reasonable calculated / translated quantitative statement

higher in summer than in winter for 2 marks
comparative statements may be worth 2 marks
but
8/11 times higher in summer than in winter for 3 marks

1

(b) no artificial light given in summer / light only given in winter

since natural light greatly exceeds minimum / 600 J (required to produce tomatoes)

accept day length if linked to light energy

OR

light only given in winter

as natural light less than the minimum needed (to grow them) or 600 J

OR

for 2 marks:
percentage increase in growth from artificial] light only significant in winter

2

[5]

23 plants

1

carbohydrates

accept oxygen

1

carbon dioxide

accept water
(these words must be in this order)

1

[3]

24 carbon dioxide concentration

1

since atmospheric concentration very low / value give e.g. 0.03%

allow carbon dioxide used up

1

temperature high

allow if light chosen as a factor

1

light intensity high

allow If temperature chosen as a factor

1

[4]

25 (a) genes

1

asexual

1

clones

1

(b) keeps cuttings damp / prevents wilting

allow keeps warm / acts like a greenhouse
allow keeps pests off

1

[4]

26 use less nitrate / fertiliser

accept use none

use a different fertiliser is neutral
prevent nitrate fertiliser run off is neutral

1

any **two** from:

explanation that with less or none the crops still grow

make more land available to grow more crops

monitoring of water

legislation

organic farming / manure

genetically modified crops

give babies bottled water

2

[3]

27 (a) respiration

reject start respiring / respire only at night

1

no photosynthesis because no light

1

(b) photosynthesis rate greater than respiration rate

1

reject no respiration / photosynthesis only

photosynthesis since light

1

[4]

28 (a) 6 6 6

all required

accept a '6n 6 n n 6n' version of the balanced equation provided it is correct in every detail

1

(b) any **two** of

- (presence of) chlorophyll **or** (amount of) chloroplasts
  accept green leaves (or other green parts)
- (sufficient) light (intensity)
- (light) of **a** suitable wavelength
  any light other than green light
  do not credit Sun's energy or sunshine or Sun

2

(c) **guard cells**

any **two** of

* control by osmosis
* the movement of gases
  *accept movement of carbon dioxide **or** oxygen **or** water vapour*
  beware movement of CO_2 out
  accept a diagram or description
* through the stoma

2

palisade cells

any **two** of

* near the upper surface
* contain (a great) <u>many</u> **or** <u>more</u> chloroplasts
* (so) contain the most chlorophyll

2

(d) any three of

* for respiration
* conversion to (insoluble) starch

or to food store **or** to (other)carbohydrates
* (conversion to) sucrose **or** to food store **or** to (other) carbohydrates

or polysaccharides

*do not credit just to grow **or** live*

***or** survive*

accept conversion to food store

***or** to (other) carbohydrates once only*

* (conversion to) lipids **or** fats **or** oils
* (conversion to) amino acids **or** (plant) proteins **or** auxins **or** (plant) hormones **or** enzymes

3

[10]

29 (a) (i) photosynthesis

1

(ii) respiration

do not credit combustion

do not credit decay

1

(iii) dry

*accept hot **or** windy **or** drought*

1

(b) any **three** from

* evaporation (of water)

***or** loss of water vapour*

* (mostly) from the leaf / leaves

do not credit incorrect reference to leaves

* through the stomata

accept through each stoma

accept through the stomas(sic)

* causing a pull

or *causing an increase in osmotic potential (at the top of the plant)*
or *causing an increase in water potential (at the top of the plant)* ***or*** *causing a decrease in osmotic pressure (at the top of the plant)*

* (so that) water moves up (through the plant)

do not credit water vapour moves up through the plant

* as the transpiration stream

* water enters through roots (and goes up plants)

3

[6]

30 (a) diatoms photosynthesise **or** are producers

1

the amount of growth depends upon the energy **or** light they get

accept more light means more growth
or *they multiply more in more light*
do not accept they need light

1

(b) (i) eaten by small fish

do not accept eaten by fish

1

minerals **or** nitrate **or** phosphates
or nutrients **or** food supply used up
or reduced

1

(ii) any **two** from

gets colder
light decreases
end of their life span **or** die

accept more being eaten than being formed

eaten by small fish

do not accept a decrease in nitrates
or *phosphates*

1

(c) increased minerals **or** nitrates **or** phosphates

1

any **one** from

due to death **or** decay of diatoms **or** fish

do not accept death of large fish

1

influx of minerals in an ocean current

*do not accept extraneous pollution **or** dumping by a ship*

1

[8]

31

(a) both axes labelled
both axes appropriate scale
plotting 7 correct
good attempt at line graph

each for 1 mark

4

(b) more fertiliser added more yield increased

gains 1 mark

but
yield increases with fertiliser up to maximum

gains 2 marks

yield **increase** slows down above 125/150 kg/ha

either for 1 further mark

(do **not** allow yield falls)
maximum yield with 175 kg/ha

3

[7]

32 (a) + light = + photosynthesis
+ light = + photosynthesis to a limit
limit depends on temp/CO_2 levels
+ CO_2 = + photosynthesis
+ temp = + photosynthesis
each for 1 mark

5

(b) need to raise optimum levels
when one other raised
to get max/economic yield
each for 1 mark

2

[7]

33 (a) *idea:*
wood goodness recycled/crops goodness removed
gains 1 mark

1

but
wood minerals/nutrients recycled/crops remove nutrients/minerals
gains 2 marks

wood and crops compared
for 1 mark

2

(b) (add) fertiliser/nutrients/minerals
(add) manure/animal waste/compost
any two for 1 mark each

(accept move to new area for 1 mark)
rotation
max marks 2

2

[5]

34 (a) line increasing in daylight 6 – 18 (± 2 hr)
line decreasing 0 – 6 (± 2 hr)
line decreasing 18 – 24 (± 2 hr)
for 1 mark each

but
mirror image (i.e. opposite gradients)
gains 3 marks

3

(b) *idea:*
slower growth (credit even if refers only to leaves)
less photosynthesis/glucose (than if leaves fully green)
each for 1 mark

2

[5]

35 *idea*
provide (more) light
provide (more) CO_2
provide (plenty of) water
if any one of these is low it will limit the reaction
[Do not allow answers referring to temperature,
as optimum is specified in question 3)
any three for 1 mark each

[3]

36 *ideas for*

- more food produced/increased yield
- cheaper food
- bigger income for farmer (allow profit)
- less loss/damage/spoilage of crop
- allow less wasted growth (of straw due to drawing)

any three for 1 mark each

3

ideas against

- chemicals harm people (do not accept "affect flavour")
- fertiliser costly
- fewer worms (in soil)
- weedkillers kill valued/useful wild plants
- insecticides/pesticides kill useful insects/other animals

(general idea that chemicals harm plants/animals gets only 1 of these)

- (weedkillers insecticides/pesticides/fungicides/hormones/chemicals) contaminate water
- (increased risk) pesticide resistance over production/food mountains
- possible eutrophication/nitrate in river/extra plant growth/
- explanation of eutrophication

for 1 mark each to a maximum of 4 marks

4

[7]

37 (a) idea that

- light doesn't reach deeper parts
- plants need / absorb light
- to make food

gain 1 mark each to maximum of 2

but
so they can photosynthesise

gains 2 marks

2

(b) herring will be on the bottom
herring follow / will be feeding on the copepods — independent marking points

for 1 mark each

2

[4]