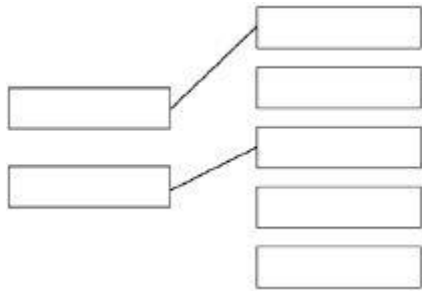


## Q1.

(a)



*additional line from a level of organisation  
negates the mark for that level of organisation*

2

(b) palisade mesophyll

1

(c)  $\frac{50}{8}$ 

1

6 / 6.25 / 6.3 (micrometres)

1

*an answer of 6 / 6.25 / 6.3 scores 2 marks*

(d) they have no chloroplasts / chlorophyll

*allow they are underground*

*allow they don't get (access to) light*

*allow (because) photosynthesis needs light*

*allow they can't absorb light*

*ignore 'sun'*

*ignore 'it is dark'*

1

(e) differentiation

1

(f) to protect endangered plants from extinction

1

(g) plants can be produced quickly

1

(h) any **one** from:

- glucose / sugars / starch
- amino acids / protein
- hormones

*allow named hormones e.g. auxin*

- ions / minerals

*allow magnesium / nitrate*

- vitamins

*allow named vitamins e.g. vitamin B*

- water

*allow H<sub>2</sub>O / H<sub>2</sub>O*

*ignore oxygen / carbon dioxide / agar / nutrients / fertiliser*

1

[10]

**Q2.**

(a) phloem

1

(b) translocation

1

(c) either:

less (sugars for) respiration

1

(so) less energy released

1

**or**

less amino acids made (1)

(so) less protein produced **or** less protein synthesis (1)

**or**

less cellulose made (1)

(so) weaker cell walls (1)

(d) (aphids) can fly to another plant **or** part of the plant

*ignore to fly unqualified*

1

to get (more) food

*allow to find a mate*

*allow idea of less competition for food*

*allow to escape predators*

*do **not** accept escape prey*

1

(e) (oil) prevents aphids from attaching to leaf **or** causes aphids to slide off leaf

*ignore 'the leaf is slippery'*

**or**

idea that oil may harm / kill the aphid

*allow oil may be unpleasant to the aphid*

1

(f) (plant / stem has) thorns

*allow spines / spikes / prickles*

*ignore stings*

*do **not** accept thorns protect (the plant) from*

- predators*
- 1
- (g) C
- if any other letter given then no marks for the question*
- 1
- (fungi / spores) blown by / in direction of the wind  
*allow black spot / disease is blown by / in direction of the wind*
- or**  
it's the closest plant (to A)  
*do **not** accept reference to bacteria / viruses / pollen being blown*
- 1
- (h) any **one** from:
- spread rose bushes out more  
*allow isolate the infected plant  
allow idea of barrier around infected plant  
ignore separate unless qualified*
  - remove any infected parts of the plant  
*allow remove infected plant / A*
  - use a fungicide  
*ignore pesticide  
do **not** accept insecticides / herbicide*
- 1
- [11]**
- Q3.**
- (a) (mouthpiece) has pierced / entered the phloem  
**or**  
(the aphid) has been feeding from the phloem
- 1
- (b) yellow leaves due to lack of chlorophyll  
*ignore 'chloroplasts'  
ignore magnesium is needed to make chlorophyll*
- 1
- (therefore) less / no light absorbed (by chlorophyll)
- 1
- (therefore) lower rate of / no photosynthesis  
*do **not** allow 'energy is produced by photosynthesis'*
- 1
- (therefore) plant makes less / no sugar / glucose
- 1

(therefore) plant converts less / no sugar / glucose into protein (for growth, so growth is stunted)

*allow less glucose / sugar converted into cellulose (cell wall)*  
*allow less energy for protein synthesis*

1

(c) inject the protein / it into a mouse

1

combine lymphocytes with tumour / cancer cells to make hybridoma (cells)

*ignore white blood cells*  
*allow T or B lymphocytes*  
*ignore tumour unqualified*

1

find a hybridoma which makes a monoclonal antibody specific to PVY

1

(the scientist) clones (the hybridoma) to produce many cells (to make the antibody)

*do **not** allow cloning of original stem cells*  
*allow many rounds of cloning / mitosis*

1

[10]

#### Q4.

(a)

	1960 – 1977	1977 – 2003	2003 – 2015
trend in carbon dioxide concentration		increasing	increasing
trend in air temperature	decreasing	increasing	constant / decreasing

1

1

*allow synonyms e.g. level / goes up / goes down*

(b) traps heat / energy or (long-wavelength / IR) radiation

*do **not** accept light / UV*

**or**

less loss of heat

*allow stops (some) heat escaping*  
*do **not** accept stops all heat escaping*

**or**

insulates

*ignore greenhouse effect*  
*ignore reference to ozone layer*

1

(c) **Level 2:** Some logically linked reasons are given. There may also be a simple judgement.

3–4

**Level 1:** Relevant points are made. They are not logically linked.

1–2

**No relevant content**

0

**Indicative content**

**for the theory:**

- (overall increased CO<sub>2</sub> parallels) overall increased temperature (e.g. by 0.4 (°C))
- CO<sub>2</sub> traps (long-wave) radiation / IR / heat

**against the theory:**

- in some years (e.g. 1960–1977) temperature falls (while CO<sub>2</sub> is rising)
- many (large and small) erratic rises and falls in temperature
- overall correlation does not necessarily mean a causal link
- other (unknown) factors may be involved in temperature change

to access level 2 there must be evidence both for and against the theory **and** use of data from the graph

(d) burning of (fossil) fuels

*allow e.g. coal / oil / gas*

*allow driving cars*

*allow any activity which leads to burning fuels – e.g. using central heating*

*ignore power stations unqualified*

*ignore burning / fires unqualified*

*ignore deforestation*

1

(e) photosynthesis

*allow full description or full equation*

*allow a symbol equation which is not balanced*

1

(f) any **two** from:

- (some) plants grow faster / higher yield
- loss of habitat
- migration **or** change in distribution\*
- extinction\*

*\*if neither is given allow alters biodiversity for 1 mark*

*allow (in terms of extinction) death due to e.g. lack of water / food or increased disease*

*ignore death unqualified*

2

*allow points made using examples*

[11]

## Q5.

(a) there is an uneven distribution of dandelions

For more help, please visit our website [www.exampaperspractice.co.uk](http://www.exampaperspractice.co.uk)

<p><b>or</b> (more) representative / valid <b>or</b> avoid bias <b>or</b> more accurate / precise mean <i>ignore accurate / precise unqualified</i> <i>ignore repeatability / reproducibility / reliability / fair test</i></p>	1
<p>(b) (correct mean per m<sup>2</sup> ⇒) 6 or 6.0</p>	1
<p>(correct field area ⇒) 55 000 (m<sup>2</sup>)</p>	1
<p>mean × area – e.g. 6(.0) × 55 000 <i>allow incorrect calculated values for mean and / or field area</i></p>	1
<p>330 000 <i>allow correct calculation from previous calculation</i></p>	1
<p>3.3 × 10<sup>5</sup> <i>allow calculated value in standard form</i>  <i>an answer of 3.3 × 10<sup>5</sup> scores 5 marks</i> <i>an answer of 330 000 scores 4 marks</i></p>	1
<p>(c) <b>Level 3:</b> The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.</p>	5–6
<p><b>Level 2:</b> The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.</p>	3–4
<p><b>Level 1:</b> The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.</p>	1–2
<p><b>No relevant content</b></p>	0
<p><b>Indicative content</b></p> <ul style="list-style-type: none"> <li>• placing of quadrat</li> <li>• large number of quadrats used</li> <li>• how randomness achieved – e.g. table of random numbers <b>or</b> random number button on calculator <b>or</b> along transect</li> <li>• quadrats placed at coordinates <b>or</b> regular intervals along transect</li> <li>• in each of two areas of different light intensities <b>or</b> transect running through areas of different light intensity</li> </ul>	

- for each quadrat count number of dandelions
- for each quadrat measure light intensity
- compare data from different light intensity

to access **level 3** the key ideas of using a large number of quadrats randomly, or along a transect, and counting the number of dandelions in areas of differing light intensity need to be given to produce a valid outcome

(d) any **two** from:

- temperature  
*allow heat*
- water  
*allow moisture / rain*
- (soil) pH  
*allow acidity*
- minerals / ions  
*allow e.g. magnesium ions or nitrate*  
*allow salts / nutrients*
- winds
- herbivores  
*allow trampling*  
*ignore carbon dioxide*  
*ignore space*  
*ignore competition unqualified*  
*do **not** accept oxygen*

2

[14]

### Q6.

- (a) rate of photosynthesis increases  
**or**  
number of bubbles produced (in one minute) increases  
**or**  
volume of gas / oxygen produced (in one minute) increases  
*allow decreases / stays the same throughout*
- (b) light intensity
- (c) reduces the effect of heat from the lamp  
**or**  
prevents temperature affecting photosynthesis
- (d) 52
- (e) should be 62  
**or**  
is to 3 s.f. / not rounded

1

1

1

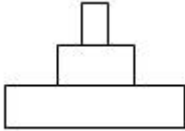
1



	<i>allow inconsistent number of significant figures / decimal places</i>	1
(f)	the numbers of bubbles at each distance are similar	1
(g)	x-axis correctly labelled (colour of light) <b>and</b> bars identified as correct colour <i>bars can be identified by labels beneath the x-axis or with a key</i>	1
	bars plotted correctly <i>all 4 correct = 2 marks 3 correct = 1 mark if wrong type of graph drawn, max 2 marks</i>	2
(h)	blue light gives highest (rate of) photosynthesis <i>allow ecf from candidate's graph allow blue light is best</i>	1
	green light gives the lowest (rate of) photosynthesis <i>allow green light is worst</i>	1
(i)	energy <i>in this order only</i>	1
	cell wall(s) <i>allow cell do <b>not</b> accept (cell) membrane</i>	1
	starch / fat / oil / lipid	1
		<b>[14]</b>
<b>Q7.</b>		
(a)	correct figures from graph: 5.0 / 5 and 2.60 / 2.6 2.40 / 2.4 <i>an answer of 2.40 / 2.4 scores 2 marks</i>	1
	<i>allow correct answer from candidate's figures from graph for 1 mark</i>	1
(b)	$\frac{1}{3}$	1
(c)	protein	1





- (d) a genetically-modified variety of seed was sown in 2004 1
- more rain fell in spring and early summer in 2004 1
- the mean summer temperature was lower in 2003 1
- (e)  1
- (f) 80 1
- (g) chickens use energy for movement and for keeping warm 1
- much of the food eaten by chickens is wasted as faeces 1
- [11]**

**Q8.**

- (a) to kill virus  
or  
to prevent virus spreading 1
- (b) take (stem) cells from meristem  
or  
tissue culture  
*allow take cuttings* 1
- (c) use Benedict's solution 1
- glucoses turns solution blue to orange 1
- (d) **Level 2 (3–4 marks):**  
A detailed and coherent explanation is provided. The student makes logical links between clearly identified, relevant points that explain why plants with TMV have stunted growth.
- Level 1 (1–2 marks):**  
Simple statements are made, but not precisely. The logic is unclear.
- 0 marks:**  
No relevant content.

**Indicative content**

- less photosynthesis because of lack of chlorophyll



- therefore less glucose made  
so
- less energy released for growth
- because glucose is needed for respiration  
and / or
- therefore less amino acids / proteins / cellulose for growth
- because glucose is needed for making amino acids / proteins / cellulose

4

**[8]****Q9.**

(a)  $(140 + 240 + 380 + 450 = )$  1210

1

(b) the local people decided to farm cattle

1

a company starts growing plants for biofuels

1

(c) carbon dioxide

*in this order only*

1

photosynthesis

1

(d) animals and birds migrate because there is less food

1

more habitats are destroyed

1

(e) any **one** from:

- breeding programmes (for endangered species)
- regeneration (programmes)
- reintroduction of field margins / hedgerows
- awareness raising with politicians / public
- recycling

1

**[8]****Q10.**

(a) methane is produced

*ignore bad smell*

1

which is a greenhouse gas / causes global warming

1

(b)  $(9.80 / 0.20 = 49$  therefore) 49:1

1

(c) horse (manure)

*allow ecf from 11.2*

closest to 25:1 (ratio)

1

(d) **Level 3 (5–6 marks):**

A detailed and coherent explanation is given, which logically links how carbon is released from dead leaves and how carbon is taken up by a plant then used in growth.

**Level 2 (3–4 marks):**

A description of how carbon is released from dead leaves and how carbon is taken up by a plant, with attempts at relevant explanation, but linking is not clear.

**Level 1 (1–2 marks):**

Simple statements are made, but no attempt to link to explanations.

**0 marks:**

No relevant content.

**Indicative content**

**statements:**

- (carbon compounds in) dead leaves are broken down by microorganisms / decomposers / bacteria / fungi
- photosynthesis uses carbon dioxide

**explanations:**

- (microorganisms) respire
- (and) release the carbon from the leaves as carbon dioxide
- plants take in the carbon dioxide released to use in photosynthesis to produce glucose

**use of carbon in growth:**

- glucose produced in photosynthesis is used to make amino acids / proteins / cellulose
- (which are) required for the growth of new leaves

6

(e) any **three** from:

(storage conditions)

- (at) higher temperature / hotter
- (had) more oxygen
- (had) more water / moisture
- (contained) more microorganisms (that cause decay)

*allow reference to bacteria / fungi / mould*

3

[13]

**Q11.**

(a) any **two** from:

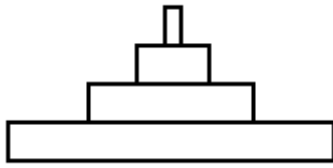
- *idea of* absorption of light / energy
- transfer to chemical energy

*allow produce sugars / glucose / starch / carbohydrate / food / biomass*

- provides food / energy for animals / caterpillar
- releases oxygen

For more help, please visit our website [www.exampaperspractice.co.uk](http://www.exampaperspractice.co.uk)

2



(b)

1

(c) 15(%)

$$\frac{3 \times 100}{20}$$

allow 1 mark for  $\frac{3 \times 100}{20}$  with no answer or incorrect answer  
**or**

allow 1 mark for 0.15

2

(d) (i) any **two** from:

- markings look like eyes / face / mouth of much larger animal
- looks fierce / scary / dangerous  
*allow it looks like a snake*
- to frighten blue tit / bird

max 1 if reference to camouflage

2

(ii) any **two** from:

- sharp / long / big claws  
*ignore strong*
- sharp / hooked beak  
*ignore strong / big*
- large wings **or** flies quickly  
*allow streamlined / aerodynamic*  
*ignore powerful wings*
- good eyesight

2

**[9]****Q12.**

(a) (i) reduced photosynthesis

*ignore growth*

**do not allow need light for respiration**

1

(ii) less food (for animals) **or** less oxygen (for animals)

*allow loss of habitat*

1

(iii) any **two** from:

*accept 2 physical factors or 2 biological factors or one of each for full marks*

examples of physical factors, eg

- flooding
- drought

- ice age / temperature change  
*ignore pollution*
  - volcanic activity
- examples of biological factors, eg
- (new) predators (allow hunters / poachers)
  - (new) disease / named pathogen
  - competition for food
  - competition for mates
  - cyclical nature of speciation
  - isolation
  - lack of habitat or habitat change
- If no other answers given allow natural disaster / climate change / weather change / catastrophic event / environmental change for 1 mark*
- 2
- (b) (i) 3
- 1
- (ii) fossils  
*ignore bones, remains, fossil fuels*
- 1
- (c) (i) 65 million years ago
- 1
- (ii) 17  
*allow ecf*
- 1
- (iii) fossil record incomplete  
**or**  
some fossils destroyed  
*accept not enough evidence*  
**or**  
*cannot perform experiment to test*
- 1

[9]

**Q13.**

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

**Level 3 (5–6 marks):**

A description of how the apparatus is used to measure the **rate** of photosynthesis at different light **intensities** is given.

For full marks reference must be made to a control variable

**or**

repeats

**Level 2 (3–4 marks):**

A description of how the apparatus is set up

**and**

a description of how photosynthesis can be measured.

**or**

a description of how light intensity is varied

**or**

a control variable **or** any other relevant point

**Level 1 (1–2 marks):**

A partial description of how the apparatus is set up

**or**

a description of how light is supplied

**or**

a simple description of how photosynthesis can be measured.

**or**

a control variable

**0 marks:**

No relevant content.

**examples of the points made in the response:**

- apparatus set up:
  - weed in water in beaker
  - light shining on beaker
- method of varying the light intensity—eg changing distance of lamp from plant
- method of controlling other variables
  - use same pond weed **or** same length of pond weed
  - temperature: water bath or heat screen
  - CO<sub>2</sub>
- leave sufficient time at each new light intensity before measurements taken
- method of measuring photosynthesis – eg counting bubbles of gas released or collecting gas and measuring volume in a syringe
- measuring **rate of photosynthesis** by counting bubbles for set period of time
- repetitions

**extra information:**

*allow information in the form of a diagram*

[6]

**Q14.**

(a) 6H<sub>2</sub>O

*in the correct order*

1

C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>

1

(b) (i) control

**do not accept** 'control variable'

*allow:*

*to show the effect of the organisms*

**or**

*to allow comparison*

**or**

*to show the indicator doesn't change on its own*



- (ii) snail respire 1
- releases CO<sub>2</sub> 1
- (iii) turns yellow 1
- plant can't photosynthesise so CO<sub>2</sub> not used up 1
- but the snail (and plant) still respire so CO<sub>2</sub> produced 1

[8]

**Q15.**

- (a) (i) LHS = water 1  
*accept H<sub>2</sub>O*  
*do not accept H<sup>2</sup>O / H<sub>2</sub>O*
- RHS = oxygen 1  
*accept O<sub>2</sub>*  
*do not accept O / O<sup>2</sup> / O<sub>2</sub>*
- (ii) light / sunlight 1  
*ignore solar / sun / sunshine*  
*do not allow thermal / heat*
- (iii) chloroplasts 1  
*allow chlorophyll*
- (b) (i) 20 1
- (ii) any **one** from: 1  
• light (intensity)  
• temperature.
- (c) (i) To increase the rate of growth of the tomato plants 1
- (ii) Because it would cost more money than using 0.08% 1
- Because it would not increase the rate of photosynthesis of the tomato plants any further 1

[9]

**Q16.**

- (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]****Q17.**

- (a) LHS = water 1

RHS = glucose 1

- (b) any **three** from:
- (measure) temperature  
*ignore reference to fair test*
  - to check that the temperature isn't changing
  - rate of reaction changes with temperature
  - temperature is a variable that needs to be controlled  
*allow lamp gives out heat*
- 3

- (c) (i) 10  
*correct answer = 2 marks*  
*allow 1 mark for:  $\frac{(10+9+11)}{3}$*

*allow 1 mark for correct calculation without removal of*



	<i>anomalous result ie 15</i>	2
(ii)	graph: <i>allow ecf from (c)(i)</i>	
	label on y-axis as 'number of bubbles per minute'	1
	<b>three</b> points correct = <b>1</b> mark <i>allow <math>\pm 1</math> mm</i>	
	<b>four</b> points correct = <b>2</b> marks	2
	line of best fit = smooth curve	1
(iii)	as distance increases, rate decreases – pro <i>allow yes between 20 – 40</i>	1
	but should be a straight line / but line curves – con / not quite pro <i>allow not between 10 – 20</i> <i>if line of best fit is straight line, allow idea of poor fit</i>	1
(d)	any <b>four</b> from:	
	<ul style="list-style-type: none"> <li>• make more profit / cost effective</li> <li>• raising temp. to 25 °C makes very little difference at 0.03% CO<sub>2</sub></li> <li>• (at 20 °C) with CO<sub>2</sub> at 0.1%, raises rate</li> <li>• (at 20 °C with CO<sub>2</sub> at 0.1%) → &gt;3x rate / rises from 5 to 17</li> <li>• although 25 °C → higher rate, cost of heating not economical</li> <li>• extra light does not increase rate / already max. rate with daylight</li> </ul> <i>accept ref to profits c.f. costs must be favourable</i>	4
		[17]
<b>Q18.</b>		
(a)	(i) chloroplast	1
	(ii) cell wall	1
(b)	(i) osmosis <i>accept diffusion</i>	1
	(ii) cell wall (prevents bursting)	1
(c)	(i) carbon dioxide <i>allow correct formula</i>	1

- glucose  
*allow sugar / starch* 1
- (ii) any **two** from:
- light sensitive spot detects light
  - tells flagellum to move towards light
  - more light = more photosynthesis
- 2
- (d) (cell has) larger SA:volume ratio 1
- short (diffusion) distance  
*allow correct description* 1
- (diffusion) via cell membrane is sufficient / good enough
- or**
- flow of water maintains concentration gradient 1

[11]

**Q19.**

- (a) (i) traps light (energy)  
*allow uses light / converts light energy to chemical energy* 1
- for photosynthesis / for making sugar / starch / carbohydrates  
*ignore food*  
*allow organic molecules* 1
- (ii) dodder takes sugar / glucose / sucrose from phloem / dodder cannot make its own glucose / carbohydrate
- or**
- phloem has sugar / glucose / sucrose  
*accept amino acids / fatty acids / other small organic molecule*  
*ignore takes food / minerals / water / nutrients* 1
- (iii) any **one** from:
- not enough sugar / nutrients to grow / respire  
*accept not enough food to grow / respire*
  - might strangle / restrict growth by squeezing stem tightly
  - may damage stem tissues by growing into it
  - may smother leaves / block light **so** less photosynthesis / less growth

- (b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1 – 2 marks)**

Description and explanation of an adaptation which only involves hooks **and / or** suckers.

**Level 2 (3 – 4 marks)**

Description and explanation of adaptations including hooks **and / or** suckers with any other adaptation **or** explanation.

**Level 3 (5 – 6 marks)**

Description of most correct adaptations **and** explanations.

**Examples of biology points made in the response:**

- hooks – for holding on / not being detached
  - suckers – for holding on / not being detached
  - flattened / large surface area – absorption of (large amounts of) food
  - no gut – not needed as host digests food
  - thick cuticle – protection from host's enzymes / so not digested
  - large number of eggs – increased chance of infecting new host
- allow hermaphrodite and self-fertilising – likely to be just one worm per host*
- internal fertilisation – gametes not digested*

6

[10]

**Q20.**

- (a) (i) in the direction of the force of gravity 1
- (ii) against the force of gravity 1
- (b) (i) diagram completed to show stem bending / leaning towards the window  
*the bend / lean can be at / from any point above pot level*  
*ignore any leaves* 1
- (ii) more light (for leaves)  
*ignore heat* 1
- more photosynthesis / biomass / glucose  
*ref to 'more' needed once only, eg 'more light for photosynthesis' = 2 marks*  
*if no other marks given allow 1 mark for 'to get light for*

*photosynthesis'*

1

[5]

**Q21.**

(a) chlorophyll is needed for photosynthesis

1

light is needed for photosynthesis

1

(b) increases

1

levels off / reaches a maximum / remains constant / stays the same / plateaus

*do **not** allow stops / stationary / peaks*

*allow stops increasing*

1

goes up to / reaches a maximum / levels off at (a rate of) 200 (arbitrary units)

**or**

levels off at 225 – 240 (light units)

*ignore references to other numerical values*

1

(c) (i) higher light intensity does not increase rate of photosynthesis

*accept the graph stays level (above this value)*

*allow stops increasing*

*allow the rate of photosynthesis stays the same (above this value)*

1

(ii) any **two** from:

- carbon dioxide (concentration)
- temperature / heat
- (amount of) chlorophyll / chloroplasts

*allow water*

*allow ions / nutrients*

*ignore ref to surface area of the leaf*

2

[8]

**Q22.**

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content

**Level 1 (1 – 2 marks)**

There is at least one reason for deforestation

**or**

an attempt at a description of at least one way deforestation is affecting the atmosphere.

**Level 2 (3 – 4 marks)**

There is at least one reason for deforestation

**and**

a description of the way deforestation is affecting one gas in the atmosphere

**or**

the process that causes an effect.

**Level 3 (5 – 6 marks)**

There are reasons for deforestation

**and**

a clear description of the way deforestation is affecting one gas in the atmosphere

**and**

the process that causes this.

**examples of the points made in the response**

Reasons for deforestation

- timber for construction / furniture / boat building / paper production
- growing plants for biofuels for motor fuel / aviation / lawnmowers
- use of wood as a fuel
- land for building or agriculture to provide food, such as rice fields and cattle ranching

Effects of deforestation

- increase in carbon dioxide in atmosphere  
due to burning  
due to activities of microbes  
less carbon dioxide taken in / locked up (by trees)  
less photosynthesis
- increase in methane in atmosphere  
due to rice production / cattle

***extra information***

*ignore references to oxygen*

*accept explanations of the effect of water (vapour)*

[6]

**Q23.**

(a) any **one** from:

*ignore 'check temperature'*

- add a water bath
- heat screen
- use LED
- low energy bulb / described

For more help, please visit our website [www.exampaperspractice.co.uk](http://www.exampaperspractice.co.uk)

1

- (b) (i) rate / number of bubbles decreases  
*accept converse with reference to increasing light or shorter distance*

**or**

less oxygen / gas released  
*ignore reference to rate of photosynthesis*

1

- (ii) temperature / CO<sub>2</sub> (concentration)  
*accept 'it was too cool' or not enough CO<sub>2</sub>*  
*accept number of chloroplasts / amount of chlorophyll*  
*allow heat*  
*allow CO<sub>2</sub>*  
*do not allow CO<sub>2</sub>*

1

- (c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

**0 marks**

No relevant content.

**Level 1 (1-2 marks)**

There is a brief description of at least 1 tissue **or** at least 1 function of an indicated part of the leaf.

The account lacks clarity or detail.

**Level 2 (3-4 marks)**

There is a clear description which includes at least 1 named tissue and at least 1 correct function described for an indicated part of the leaf.

**Level 3 (5-6 marks)**

There is a detailed description of most of the structures and their functions.

**Examples of responses:**

- epidermis
- cover the plant
- mesophyll / palisade
- photosynthesises
- phloem
- xylem

- transport.

**The following points are all acceptable but beyond the scope of the specification:**

- (waxy) cuticle – reduce water loss
- epidermis – no chloroplasts so allows light to penetrate
- stomata / guard cells – allow CO<sub>2</sub> in (and O<sub>2</sub> out) **or** controls water loss
- palisade (mesophyll) – many chloroplasts to trap light  
– near top of leaf for receiving more light
- spongy (mesophyll) – air spaces for rapid movement of gases

6

[9]

### Q24.

- (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*

	for growth		1
	<i>dependent on 1<sup>st</sup> mark</i>		1
			<b>[9]</b>
<b>Q25.</b>			
(a)	(i) <b>C and D</b>		
	<i>no mark if more than one box is ticked</i>		1
	(ii) any <b>one</b> from:		
	<i>do not allow if other cell parts are given in a list</i>		
	• (have) cell wall(s)		
	• (have) vacuole(s)		1
(b)	(i) <b>A</b>		
	<i>apply list principle</i>		1
	(ii) <b>D</b>		
	<i>apply list principle</i>		1
(c)	respiration		
	<i>apply list principle</i>		1
			<b>[5]</b>
<b>Q26.</b>			
(a)	The starch is stored for use later		
	<i>no mark if more than one box is ticked</i>		1
(b)	(i) any <b>two</b> from:		
	<i>do not accept temperature</i>		
	<i>apply list principle</i>		
	<i>ignore reference to time</i>		
	• carbon dioxide (concentration)		
	• light intensity		
	• light colour / wavelength		
	<i>allow 1 mark for light if neither intensity or colour are awarded</i>		
	• pH		
	• size / amount of pondweed / plant		





- same / species / type pondweed
  - amount of water in the tube  
*ignore amount of water alone*
- 2
- (ii) number / amount of bubbles **or** amount of gas / oxygen  
*allow volume of bubbles (together)*  
*ignore 'the bubbles' unqualified*
- 1
- (relevant reference to) time / named time interval  
*allow how long it bubbles for*  
*do **not** accept time bubbles start / stop*  
*ignore speed / rate of bubbling*  
*ignore instruments*  
*do **not** accept other factors eg temperature*  
*accept how many bubbles per minute for **2** marks*
- 1
- (c) (i) temperature  
*allow heat / cold / °C*
- 1
- (ii) carbon dioxide / CO<sub>2</sub>  
*allow CO<sub>2</sub>*  
*do **not** accept CO<sup>2</sup>*
- 1

[7]

**Q27.**

- (a) oxygen  
*allow O<sub>2</sub> / O<sub>2</sub>*  
*do **not** accept O<sup>2</sup> or O*
- 1
- (b) (i) light
- 1
- (ii) chlorophyll
- 1
- (iii) decrease
- 1
- (c) any **three** from:
- for respiration / energy  
*do **not** accept use energy for photosynthesis*
  - to make cellulose / starch  
*accept named carbohydrate other than glucose*
  - to make lipid / fat / oil  
*accept fatty acid / glycerol*



- to make protein  
*accept named protein / amino acid / named amino acid*
- to build big molecules from small molecules / metabolism  
*if no other marks awarded for making molecules allow 1 mark for growth / repair / new cells*

3

[7]

**Q28.**

- (a) (i) decrease

1

rate of decrease slows

1

- (ii) any **one** from:

- more use of disinfectant  
*allow any reasonable increase in hygiene or sterilisation precautions*
- more use of hand washing
- more careful / more often cleaning of patient facilities
- raised awareness / education about hygiene

1

Explanation:

stops / reduces the bacteria being transferred / spreading

1

- (iii)  $800 - 500 / 800 \times 100 =$

1

37.5 (%)

*correct answer with or without working gains 2 marks*

1

- (iv) any **one** from:

- numbers quite low now so hard to reduce further
- was a big campaign / much publicity (in 2009) so more people already doing it
- hygiene / cleaning now good so hard to improve
- hospitals short of money so less staff to clean

1

- (b) mutation occurred giving resistance (to methicillin)  
*do **not** accept overuse caused mutation*

1

resistant bacteria not able to be treated / not killed

1

these bacteria multiplied / reproduced / spread quickly

1

[10]

**Q29.**

- (a) protein 1
- (b) (i) (more) magnesium gives more growth / more leaves / more duckweed  
*if converse must be clear that less magnesium gives less growth* 1
- (ii) **A** gave highest number of leaves / plants **or** more than others  
*it equals 'A'*  
*use of numbers must compare A with at least one other*
- or**
- A** gave most growth / most duckweed **or** more than others  
*allow faster / fastest / better / best growth*  
*allow more growth with nitrate / less growth without nitrate*  
*do not allow 'no' growth without nitrate*
- (c) (i) mark (c) as a whole
- sensible method:
- e.g. mass / weighing  
*ignore dry or fresh*  
*allow other sensible method involving measuring eg length of roots – ignore 'size' of roots or measure roots unqualified* 1
- (ii) corresponding explanation:  
*ignore accuracy*
- e.g. includes roots / includes whole plant  
**or**  
leaves vary in size  
**or**  
(length / mass / surface area given in c(i)) is a continuous variable 1

**[5]****Q30.**

- (a) xylem **and** phloem  
*either order*  
*allow words ringed in box*  
*allow mis-spelling if unambiguous* 1
- (b) (i) movement / spreading out of particles / molecules / ions / atoms  
*ignore names of substances / 'gases'* 1
- from high to low concentration

*accept down concentration gradient*  
*ignore 'along' / 'across' gradient*  
*ignore 'with' gradient*

1

(ii) oxygen / water (vapour)

*allow O<sub>2</sub> / O<sub>2</sub>*  
*ignore O<sup>2</sup> / O*  
*allow H<sub>2</sub>O / H<sub>2</sub>O*  
*ignore H<sup>2</sup>O*

1

[4]

**Q31.**

(a) LHS – carbon dioxide / CO<sub>2</sub>

*allow CO<sub>2</sub>*  
*ignore CO<sup>2</sup>*

1

RHS

*in either order*

glucose / carbohydrate / sugar

*allow starch*  
*allow C<sub>6</sub>H<sub>12</sub>O<sub>6</sub> / C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>*  
*ignore C<sup>6</sup>H<sup>12</sup>O<sup>6</sup>*

1

oxygen

*allow O<sub>2</sub> / O<sub>2</sub>*  
*ignore O<sup>2</sup> / O*

1

(b) any **five** from:

- factor 1: CO<sub>2</sub> (concentration)
- effect - as CO<sub>2</sub> increases so does rate and then it levels off or shown in a graph
- explanation:  
 (graph increases) because CO<sub>2</sub> 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*

*2<sup>nd</sup> or 3<sup>rd</sup> mark can be gained from correct description and explanation*

5

[8]

### Q32.

(a) water

1

oxygen

*in this order only*

*accept correct chemical symbols*

*allow H<sub>2</sub>O / OH<sub>2</sub>*

1

(b) allow light (in / through) / need light

*do **not** accept attracts light*

*ignore heat / moisture / carbon dioxide*

*ignore so the plants can be seen*

*accept the converse, ie the black plastic bag would not let light in (1)*

1

for photosynthesis / make sugar / glucose

*so there would be no photosynthesis (1)*

*do **not** allow make food unqualified*

1

(c) Increase (in leaves / new leaves)

*ignore growth unqualified*

1

(then) level off **or** number of (new) leaves (then) stays the same

1

numerical statement eg max at 3 tablets / 5 (new) leaves

*should refer to one of the first two marking points*

*for every extra tablet get 1 extra leaf = **2** marks*

*for every extra tablet get 1 extra leaf then it levels off = **3***



marks

1

[7]

**Q33.**

- (a) less carbon dioxide used  
or higher carbon dioxide (concentration) in jar  
*do not allow no carbon dioxide used or no change in carbon dioxide*

1

because less photosynthesis or light was a limiting factor  
*do not allow no photosynthesis*

1

- (b) magnesium / Mg  
*do not allow manganese / Mn*  
*allow iron / Fe*  
*ignore nitrates*

1

[3]

**Q34.**

- (a) (i) sun  
*ignore light*  
*apply list principle*

1

- (ii) photosynthesis  
*apply list principle*  
*allow approximate spelling*  
*do not accept phototropism*

1

- (b) (i) chemical

1

- (ii) carbon dioxide

1

- (iii) carbohydrates

1

- (c) As carbon dioxide from the caterpillar  
*if more than 2 boxes ticked deduct one mark for each additional incorrect box*

1

As faeces (droppings) from the blue-tit

1

[7]

**Q35.**

- (a) (LHS) water / H<sub>2</sub>O  
*allow H<sub>2</sub>O*  
*do **not** accept H<sup>+</sup>O* 1
- (RHS) glucose / sugar / C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>  
*allow starch / carbohydrate*  
*allow C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>*  
*do **not** accept C<sup>6</sup>H<sup>12</sup>O<sup>6</sup>* 1
- (b) (i) 1 arbitrary unit  
*extra box ticked – cancel* 1
- (ii) 210 1
- (iii) carbon dioxide / CO<sub>2</sub> / CO<sub>2</sub>  
**or**  
temperature / heat / warmth  
*do **not** accept CO<sub>2</sub>*  
*ignore mineral ions*  
*ignore water* 1

**[5]**





**Q1.**

- (a) LHS: carbon dioxide **AND** water  
*in either order*  
*accept CO<sub>2</sub> **and** H<sub>2</sub>O*  
*allow CO2 and H2O*  
*if names given ignore symbols*  
*do **not** accept CO<sup>2</sup> / H<sup>2</sup>O / Co / CO*  
*ignore balancing* 1
- RHS: sugar(s) / glucose / starch / carbohydrate(s)  
*accept C<sub>6</sub>H<sub>12</sub>O<sub>6</sub>*  
*allow C6H12O6*  
*do **not** accept C<sup>6</sup>H<sup>12</sup>O<sup>6</sup>* 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]

**Q2.**

- (a) photosynthesis
- do **not** accept other additional processes*
- 1
- (b) (i) any **three** from, eg:
- ignore time / apparatus*
- mass of pondweed  
*type of pondweed = max 2*  
*accept amount / volume / length / size*  
*ignore number / surface area of leaves / pondweed unqualified*
  - volume of water  
*accept amount*
  - other reasonable features of the water
  - light intensity

*accept distance between light source and tube / pondweed*

- light colour  
*accept light if neither colour nor intensity is given*
- carbon dioxide
- temperature
- pH

3

(ii) any **one** idea from, eg:

*ignore reference to cost*

- how much oxygen they give off
- is pondweed poisonous to fish
- will fish eat pondweed
- is pondweed harmful to environment
- how long the pondweed lives
- growth rate / size of pondweed
- reference to appearance / aesthetics
- availability

1

(c) magnesium / Mg

*accept iron / Fe*

*ignore ion and + or -*

*ignore nitrate*

1

[6]

### Q3.

(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]

**Q4.**

(a) (i) 70

*award 2 marks for correct answer irrespective of working  
allow 1 mark for  $30 + 10 + 24 + 6$  (with wrong answer or no answer), do **not** award this sum if other figure(s) are included in the addition*

2

(ii) 6

*award 2 marks for correct answer irrespective of working  
award 2 marks for correct answer to (a)(i) – 64 (ecf)  
award 1 mark either for  $70 - 64$  or answer to (a)(i) – 64 with no answer or incorrect answer*

2

(b) photosynthesis.

1

[5]

**Q5.**

(a) (i) colour of light / bulb / lamp

*allow wavelength for colour  
allow bulb alone  
do **not** accept light / colour unqualified*

1

(ii) any **one** from eg

- temperature  
*allow heat*
- light intensity **or** distance between lamp and plant / tube  
*allow amount / brightness of light  
ignore light unqualified*
- carbon dioxide  
*allow symbols*
- other light in room  
*allow use a dark room*
- mass / size / amount / age / type of pondweed  
*allow same piece of pondweed*

	<i>ignore pondweed unqualified</i>		
	<ul style="list-style-type: none"> <li>• volume / amount of water <i>ignore reference to time</i></li> </ul>	1	
(iii)	improved reliability <i>allow for reliability <b>or</b> less likely to lose count</i>  <b>or</b> can spot anomalies / changes <i>allow reference to calculating a mean / average</i> <i>ignore reference to accuracy / precision / fair</i>	1	
(b) (i)	green	1	
(ii)	any <b>two</b> from: <i>ignore references to colour</i> <ul style="list-style-type: none"> <li>• least / less bubbles / gas / oxygen / mean <i>reference to least / less needed only once, in context, for 2 marks</i></li> <li>• least / less photosynthesis</li> <li>• least / less glucose / sugar / carbohydrate / food made <i>only penalise no once, ie</i> <i>no bubbles = 0 mark</i> <i>no bubbles so no photosynthesis = 1 mark</i> <i>allow most / more green light reflected (by chloroplasts)</i></li> </ul>	2	[6]
<b>Q6.</b>			
(a)	add mineral ions to the soil <i>extra box ticked cancels the mark</i>	1	
(b)	increasing the temperature <i>each extra box ticked cancels 1 mark</i>	1	
	turning lights on at night	1	[3]
<b>Q7.</b>			
	any <b>three</b> from: <i>maximum 2 marks if only advantages <b>or</b> only disadvantages</i>		

*given*

*ignore references to cost unqualified*

advantages: (max 2)

*ignore reference to fresher*

- less transport / example of transport **or** less fuel used  
*accept implication eg less food miles*  
*allow no transport / fuel costs*
- less pollution / example  
*accept eg less carbon dioxide / smaller carbon footprint*  
*allow no pollution / example*
- support of local / UK economy / farmers

disadvantages: (max 2)

- not available all year
- may require use of heat / light
- (production of) heat / light causes pollution

[3]

### Q8.

- (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) CO<sub>2</sub> is limiting at low CO<sub>2</sub> / at first  
*ignore specific numbers*

1

light is limiting at high CO<sub>2</sub> / 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

**Q9.**

- (a) root 1
- (b) (i) chlorophyll 1
- (ii) absorbs / traps / takes in light  
*do not accept attracts / solar energy / sunshine / sun* 1
- (for) photosynthesis  
*accept to make food / glucose / sugar/ biomass* 1

- | Mineral ion | Effect of its shortage |
|-------------|------------------------|
| Magnesium   | Yellow leaves          |
| Nitrate     | Stunted growth         |
|             | White flowers          |
- (c)
- 1 mark per correct line  
extra line from a mineral ion cancels the mark*
- 2

**Q10.**

- (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]

### Q11.

(a) the starch is stored for later use.

1

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

*do **not** accept temperature-apply list principle*  
*ignore reference to time*

- carbon dioxide (concentration)
- light intensity  
*allow **one** mark for light if neither intensity or colour are awarded*
- light colour / wavelength
- pH
- size / amount plant
- same / species / type plant



- allow 'the plant'*
- amount of water in the tube  
*ignore amount of water alone* 2
- (ii) number / amount of bubbles **or** amount of gas / oxygen  
*allow volume of bubbles (together)*  
*ignore 'the bubbles' unqualified* 1
- (relevant reference to) time / named time interval  
*allow how long it bubbles for*  
*do **not** accept time bubbles start / stop*  
*ignore speed / rate bubbles*  
*ignore instruments*  
*do **not** accept other factors eg temperature*  
*accept how many bubbles per minute for **2** marks* 1
- (c) (i) temperature  
*allow heat / °C / cold* 1
- (ii) carbon dioxide / CO<sub>2</sub>  
CO<sub>2</sub> / CO<sup>2</sup> / Co<sub>2</sub> / Co<sup>2</sup> / co<sub>2</sub> / co<sup>2</sup>  
*do **not** accept CO / 2CO* 1

[7]

**Q12.**

- (a) any **one** from:
- (type of / amount of) soil / minerals / nutrients / pH
  - amount of water / time of watering
  - space between plants / plants and wall
  - time for growth  
*list principle*  
*ignore carbon dioxide / same number of plants / food*  
*do **not** allow temperature / light / exposure to wind* 1
- (b) (i) North wall 1
- (ii) nugget  
*list principle* 1
- (c) has not tested all varieties / nugget / champion against all walls

do **not** allow repeat experiment

1

[4]

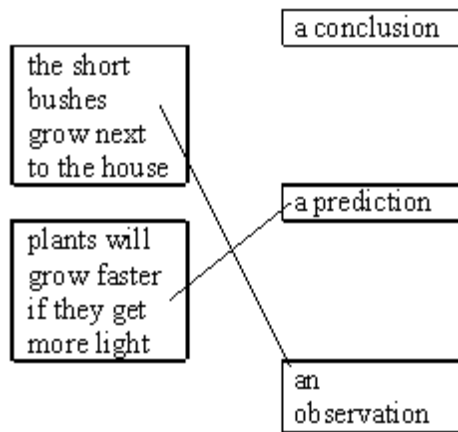
**Q13.**

- (a) (i) water / H<sub>2</sub>O  
*allow hydrogen oxide*  
 1
- oxygen / O<sub>2</sub> / 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]

**Q14.**

- (a) (i)



*both correct = 2 marks*

*one correct = 1 mark*

*extra line from a statement cancels the mark*

2

- (ii) 1<sup>st</sup> space: carbon dioxide  
*allow CO<sub>2</sub> (ignore superscript)*  
*do **not** allow CO alone*

1

2<sup>nd</sup> 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]

**Q15.**

(a) photosynthesis

1

(b) oxygen

1

(c) chlorophyll

1

(d) starch

1

[4]

**Q16.**

(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<sub>2</sub>
- 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**

For more help, please visit our website [www.exampaperspractice.co.uk](http://www.exampaperspractice.co.uk)



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]**

**Q17.**

(a) (i) L.H.S. – water / H<sub>2</sub>O

1

R.H.S. – oxygen / O<sub>2</sub>

*accept H<sup>+</sup>O*

*accept O<sup>2</sup> / 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<sub>2</sub> available or not enough CO<sub>2</sub>

available **or** rate would be higher with more CO<sub>2</sub>

1

(ii) temperature

*allow water / rain*

*allow (too) cold / hot as a minimum*

*allow wave length / frequency / colour*

*ignore ions*

*ignore heat*

1

[6]

**Q18.**

- (a) burning fossil fuels / coal / gas / oil  
*accept driving vehicles / eg cars*  
*accept coal-fired power station*  
*accept car emissions*  
*ignore combustion unqualified*  
*do **not** accept power station unqualified*  
*do **not** accept using fossil fuels* 1
- (b) (i) (SO<sub>2</sub>) makes it acidic / makes acid rain / lowers pH 1
- (ii) any **one** from:  
 (SO<sub>2</sub>) 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<sub>2</sub>) lowers pH of soil / makes soil acidic  
 ions (/minerals / salts / nutrients) less available (to plants)  
*accept don't get enough nutrients* 2

[5]

**Q19.**

- (a) carbon dioxide/CO<sub>2</sub> 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]

### Q20.

(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 in the phloem

*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<sub>2</sub>  
 humidity

[15]

**Q21.**

- (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<sub>2</sub> through the leaf

**or**

stomata

**or**

by diffusion

1

- (d) any **one** point:

increased CO<sub>2</sub> 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<sub>2</sub> from respiration*

**Q22.**

- (a) (i) light **or** solar  
*do not credit sun's energy*  
*do not credit radiant* 1
- (ii) chlorophyll 1
- (iii) chloroplast 1
- (iv)  $\text{CO}_2 + \text{H}_2\text{O}$   
*reactants identified (accept words)* 1
- $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$   
*products identified (accept words)* 1
- $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$   
*balanced equation* 1
- (b) any **two** from:  
 increased  $\text{CO}_2$  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
  - $\text{CO}_2$  in **or**  $\text{O}_2$  out **or** water vapour out
  - controls size of stoma **or** pores in

leaf

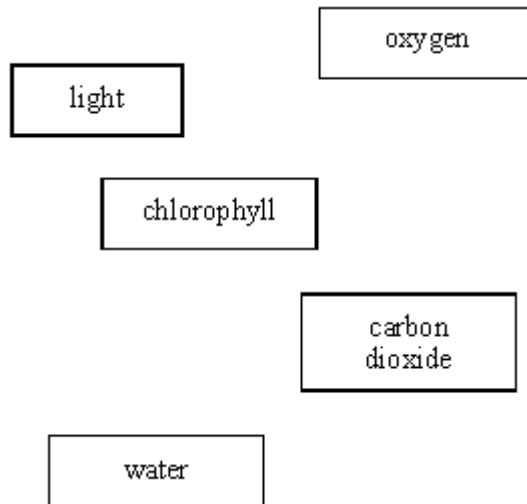
*allow stomata*

4

[12]

**Q23.**

(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]

**Q24.**

- (a) reactants:  $\text{CO}_2 + \text{H}_2\text{O}$  1
- products:  $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2$  1
- balance:  
 $6\text{CO}_2 + 6\text{H}_2\text{O} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$  1
- (b) 1 mark each for any of the following ideas:  
lower  $\text{CO}_2$  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  $50^\circ\text{C}$*  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]****Q25.**

Does not contain chlorophyll which is needed to absorb light **or** energy  
*each for 1 mark*

**[2]****Q26.**

- (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]

**Q27.**

- (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]

**Q28.**

- (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]

**Q29.**

- (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]

**Q30.**

- (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' but 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]

**Q31.**

- (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 parent  
(reject all the same)  
*disadvantage*  
all the same / all get same disease  
for 1 mark each

2

[3]

**Q32.**

- (a) (i) carbon dioxide / CO<sub>2</sub> (reject CO)  
(ii) oxygen / O<sub>2</sub> / O (reject water vapour)  
for 1 mark each

2

- (b) (provides) energy  
for 1 mark

1

[3]

**Q33.**

- (a) (i) carbon dioxide / CO<sub>2</sub> (reject CO)  
(ii) oxygen / O<sub>2</sub> / 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]****Q34.**

- (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]****Q35.**





Biology

Mark scheme

plants

1

carbohydrates

*accept oxygen*

1

carbon dioxide

*accept water*

*(these words must be in this order)*

1

**[3]**

**Q1.**

- 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]****Q2.**

- (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]****Q3.**

- 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]

**Q4.**

(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]

**Q5.**

(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<sub>2</sub> out*

*accept a diagram or description*

\* through the stoma

2

**palisade cells**

any **two** of

\* near the upper surface

\* contain (a great) many **or** more 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]

**Q6.**

(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]****Q7.**

- (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]****Q8.**

(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]****Q9.**

(a) + light = + photosynthesis  
+ light = + photosynthesis to a limit  
limit depends on temp/CO<sub>2</sub> levels  
+ CO<sub>2</sub> = + 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*

**Q10.**

- (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

**Q11.**

- (a) line increasing in daylight 6 – 18 ( $\pm 2$  hr)  
line decreasing 0 – 6 ( $\pm 2$  hr)  
line decreasing 18 – 24 ( $\pm 2$  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

**Q12.**

*idea*  
provide (more) light  
provide (more) CO<sub>2</sub>  
provide (plenty of) water  
if any one of these is low it will limit the reaction



[Do not allow answers  
as optimum is specified in question 3)

referring to temperature,

*any three for 1 mark each*

[3]

### Q13.

*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]

### Q14.

(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  
*for 1 mark each*

independent marking points

2

[4]