

**AQA GCSE BIOLOGY TOPIC 2.3  
(PLANT TISSUES, ORGANS & SYSTEMS) MARK SCHEME**

**Q1.**

- (a) (has) spikes / thorns / prickles  
*allow (has a) tough outer layer* 1
- (b) chemical 1
- (c) the plant will not lose as much water 1
- (d) chlorophyll / chloroplasts 1
- (e) to allow it to photosynthesise  
**or**  
to make sugar / glucose / carbohydrate / starch 1
- (f) organ 1
- (g) water / mineral ions  
*allow named mineral ions*  
*allow minerals / ions* 1
- (h) phloem (tissue) 1
- [8]**

**Q2.**

- (a) A 1
- (b) chloroplast(s)  
*ignore chlorophyll* 1
- (c) guard (cells)  
*ignore stoma(ta)* 1
- (d) transpiration stream  
*ignore transpiration unqualified* 1
- (e) increased humidity 1
- (f) **Level 2:** Scientifically relevant features are identified; the way(s) in



which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.

4–6

**Level 1:** Relevant features are identified and differences noted. 1–3

1–3

**No relevant content.**

0

**Indicative content:**

*Structure*

- xylem is made of dead cells  
**and**  
phloem is made of living cells
- phloem cells have pores in their end walls  
**and**  
xylem cells do not have pores in their end walls
- xylem is hollow **or** xylem does not contain cytoplasm  
**and**  
phloem contains cytoplasm
- xylem contains lignin  
**and**  
phloem does not (contain lignin)
- both made of cells
- both tubular

*Function*

- xylem transports water / mineral ions  
**and**  
phloem transports (dissolved) sugars
- xylem is involved in transpiration  
**and**  
phloem is involved in translocation
- xylem transports unidirectionally  
**and**  
phloem transports bidirectionally
- both transport liquids / substances throughout the stem / leaves / roots / plant

For **Level 2**, students must refer to both structure and function of xylem and phloem tissue.

(g) *(correct division)*

$40 \div 7$  (in hours) **or**  
 $40 \div 420$  (in minutes)

*allow correct answer from student's readings throughout*

5.71 (in hours)

**or**  
0.0952...(in minutes)





*allow correct division from incorrect reading(s) from the tangent*

1

*(correct conversion to minutes)*  
0.0952...

*allow correct conversion at any point in the calculation*

*allow correct conversion of calculated value to minutes*

1

*(answer in standard form)*  
 $9.5(238) \times 10^{-2}$

*allow correct conversion of calculated value to standard form*

1

(h) (less water loss at night)

*allow converse if clearly describing 12:00*

stomata are (almost completely) closed

1

(because) it's cooler / colder

**or**

(because) there's less / no light

*ignore it's dark at night*

1

[17]

**Q3.**

(a) movement / spreading out of molecules / particles

*allow movement / spreading out of (named)*

*substances / chemicals / gases / liquids*

*ignore reference to membranes / cells*

1

from (an area of) high(er) concentration to (an area of) low(er) concentration

*allow down / with the concentration gradient*

*ignore along / across the concentration gradient*

*do **not** accept movement from / to a concentration gradient*

1

(b) increased carbon dioxide concentration in the air

1





increased number of stomata that are open	1
(c) <b>Level 3:</b> Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	5-6
<b>Level 2:</b> Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3-4
<b>Level 1:</b> Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1-2
<b>No relevant content</b>	0
<b>Indicative content</b>	
<ul style="list-style-type: none"><li>• (many) alveoli<ul style="list-style-type: none"><li>• provide a large(r) surface area (: volume)</li></ul></li><li>• capillaries are thin<ul style="list-style-type: none"><li>• <b>or</b> alveoli / capillary walls are thin <b>or</b> one cell thick</li><li>• <b>or</b> capillaries are close to the alveoli</li><li>• which provides short diffusion path (for oxygen / carbon dioxide)</li></ul></li><li>• breathing (mechanism) moves air in and out <b>or</b> lungs are ventilated<ul style="list-style-type: none"><li>• to bring in (fresh) oxygen</li><li>• to remove carbon dioxide</li><li>• to maintain a concentration / diffusion gradient</li></ul></li><li>• large capillary network (around alveoli) <b>or</b> good blood supply<ul style="list-style-type: none"><li>• to remove oxygen(ated blood) quickly</li><li>• to bring carbon dioxide to the lungs quickly</li><li>• to maintain a concentration / diffusion gradient</li></ul></li></ul>	
(d) Osmosis <i>allow diffusion</i>	1
(e) active transport	1
(because) energy is needed	1
(to move nitrate ions) from a low(er) concentration (in the soil) to a high(er) concentration (in the root / cell) <i>allow (to move nitrate ions) against / up the concentration gradient</i> <i>allow (because) there is a lower concentration (of nitrate ions) in the soil</i> <i>or (because) there is a higher</i>	





*concentration (of nitrate ions) in the root / cell*

*ignore reference to amount / number of nitrate ions*

*ignore along / across the concentration gradient*

*do **not** accept if reference to molecules / atoms moving*

1

[14]

**Q4.**

(a) epidermis

palisade mesophyll

*allow palisade / mesophyll*

xylem

3

(b) guard cells

1

(c) to let carbon dioxide into the leaf

1

(d) by evaporation

1

(e)

*an answer of 4 (cm<sup>3</sup>) scores 2 marks*

evidence of correct graph readings (5 and 1)

*allow in range 4.8 to 5.2 and 0.8 to 1.2*

1

4 (cm<sup>3</sup>)

*allow correct subtraction from their graph readings*

*allow their calculated value from readings in the range 4.6 to 5.4 and 0.6 to 1.4*

1

(f) plant **A** has more leaves

1

(g) any **one** from:

(the new room was)

- windier
- warmer
- drier / less humid
- brighter

*answers must be comparative*







*allow sunnier*  
*ignore more sun*

1

(h) any **one** from:

- spikes / points / thorns / sharp
- poisonous / toxic
- brightly coloured berries
- leaves are tough / leathery

**or**

leaves are hard to chew

*ignore reference to predators eating*  
*holly*

*allow unpleasant taste*

1

[11]

**Q5.**

(a) (by the guard cells) opening **and** closing the stomata

*ignore ref to guard cells being*  
*plasmolysed / turgid*

1

(b) (water is) transported in xylem

*ignore mechanism of water entering the*  
*roots*

*do **not** accept translocation*

1

water evaporates (from leaves)

*allow loss of water vapour*

1

through the stomata

*allow between the guard cells*  
*if no other marks awarded allow 1 mark*  
*for reference to transpiration*

1

(c) any **one** from:

*allow converse for plant B*

- plant **A** has more stomata  
*allow (the plants) have different*  
*numbers of stomata*
- plant **A** has more leaves  
*allow (the plants) have different*  
*numbers of leaves*
- plant **A** has bigger leaves  
*allow (the plants) have different sized*  
*leaves*
- plant **A** has a greater total surface area of  
leaves *allow (the plants) have different*  
*total surface area of leaves*





*allow plant A has less (waxy) cuticle*  
**or**  
*(the plants) have different amounts of (waxy) cuticle*  
*allow plant A has fewer hairs on leaves*  
**or**  
*(the plants) have different number of hairs on the leaves*

1

(d)

*an answer of 10 scores 3 marks*

5.2

*allow in range 4.8 to 5.6*

1

$(5.2 \times 2 =) 10.4$

**or**

$$\left(\frac{5.2}{0.5} =\right) 10.4$$

*allow their calculated value in the range 8.8 to 12.0*

1

10 (cm<sub>3</sub>/hour)

*allow their calculated value in the range 8.8 to 12.0 correct to 2 significant figures*

1

(e) (rate increased because)

any **two** from:

*answers must be comparative*

- (it was) warmer
  - light intensity was higher
  - (it was) less humid
- allow greater water vapour gradient between leaves and environment*
- (it was) windier

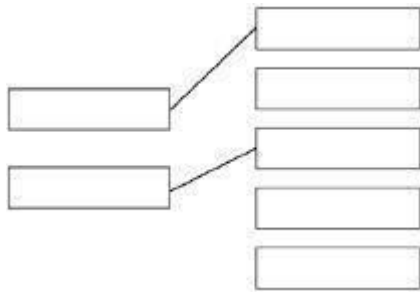
2

[10]

**Q6.**

(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]

**Q7.**

(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]

**Q8.**

(a) (A) bronchus

*allow bronchi*  
*allow bronchiole*

1

(B) trachea

*allow windpipe*

1

(C) alveolus

*allow alveoli*  
*ignore air sac*

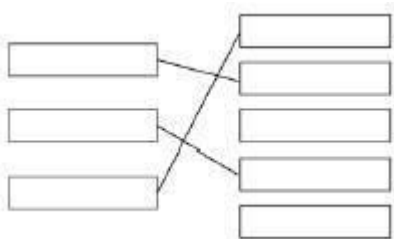
1

(b) circulatory system





- (c) Q 1
- (d) guard cell 1
- (e) a group of cells with a similar structure / function 1



- (f) 1
- 1 mark for each correct line  
extra line from a tissue negates the mark for that tissue*

3  
[10]

**Q9.**

- (a) 86 1  
*allow this answer only  
do not accept 85.7  
if no answer given, check for answer in the table*
- (b) as salt concentration increases, percentage of open stomata (in field of view) decreases (above 0.1 mol / dm<sup>3</sup>) 1  
**or**  
allow percentage of open stomata stays the same between 0.0 and 0.1 (mol / dm<sup>3</sup>) then decreases as salt concentration increases)  
*ignore references to number of open stomata  
allow converse  
allow idea that mean concentration (of salt) in guard cells is between 0.3 and 0.4 mol per dm<sup>3</sup>*
- (c) use concentrations between 0.3 (mol / dm<sup>3</sup>) and 0.4 (mol / dm<sup>3</sup>) **or** 1  
draw a graph of the data and read off the value at 50% (open stomata)  
*allow a list of appropriate concentrations i.e. 0.32 mol / dm<sup>3</sup>, 0.34 (mol / dm<sup>3</sup>), 0.36 (mol / dm<sup>3</sup>) etc.*
- (d)  $(\pi \times 0.1875^2) = 0.11$  (mm<sup>2</sup>) 1  
*an answer of 36 scores 3 marks*





$$\frac{4}{0.11}$$

1

36 (per mm<sup>2</sup>)

*allow 36.22 / 36.23 or 36.2*

*if answer is incorrect allow for 2 marks for sight of number of open stomata = 9 per mm<sup>2</sup> (diameter used instead of radius)*

*if no other marks awarded allow for 1 mark any one from:*

- *sight of area = 0.44(mm<sup>2</sup>) (diameter used instead of radius)*
- *sight of number of open stomata = 9.1 / 9.05 / 9.06 per mm<sup>2</sup> (diameter used instead of radius and no rounding)*

1

(e) (potassium) ions increase the concentration of the solution (inside guard cells)

**or**

(potassium) ions make cell more concentrated / less dilute

*allow (potassium) ions decrease concentration of water / water potential (of guard cells)*

1

water moves into the (guard) cell by osmosis

1

cell swells unevenly (so stoma opens)

1

as inner wall is less flexible than outer wall **or** thick part of the wall is less flexible than the thin part (of the wall)

1

[10]

**Q10.**

(a) electron (microscope)

1

(b)  $\frac{30000}{200}$

*an answer of 150 (µm) scores 2 marks*

1

150 (µm)

*if answer is incorrect allow for 1 mark sight of 0.015 / 0.15 / 1.5 / 15*

*allow ecf for incorrect measurement of line X for max 1 mark*

1

(c) **either**





large surface area

*allow (vacuole contains) cell sap that is more concentrated than soil water (1)*

1

for more / faster osmosis

*create / maintain concentration / water potential gradient (1)*

**or**

allow thin (cell) walls

for short(er) diffusion distance

1

(d) (on hot day) more water lost

*allow converse for a cold day if clearly indicated*

1

more transpiration

**or**

more evaporation

1

so more water taken up (by roots) to replace (water) loss (from leaves)

1

(e) (aerobic) respiration occurs in mitochondria

*do **not** accept anaerobic respiration*

1

(mitochondria / respiration) release energy

*do **not** accept energy produced / made / created*

1

(energy used for) active transport

1

to transport ions, against the concentration gradient

**or**

from a low concentration to a high concentration

1

[12]

**Q11.**

(a) active transport

1

(b) by transpiration stream / pull

1

in xylem

1







- (c) any **three** in the correct order from:
- mount epidermis on a slide
  - count stomata in one area
  - repeat in four more areas
  - repeat method on other surface of leaf
  - calculate mean
- allow nail varnish film* 3
- (d) 1
- allow numbers written out in a line with middle number circled* 1
- (e)  $(44+41+40+42+39)/5=41.2$  1
- 41
- allow 41 with no working shown for 2 marks* 1
- allow 41.2 for 1 mark*
- (f) less water lost 1
- so it does not wilt 1
- [11]

**Q12.**

- (a) guard (cells)
- allow phonetic spelling* 1
- (b) (i) as carbon dioxide (concentration) increases, the (mean) number of stomata decreases
- allow there is a negative correlation* 1
- (there is a) rapid drop initially
- allow use of any number between 1.5 and 3.0 to indicate "initially"* 1
- (ii) (there is) more carbon dioxide so plant doesn't need as many stomata (to obtain the amount needed)
- or**
- (there is) less carbon dioxide so the plant needs more stomata (to obtain enough) 1
- (c) (i) may lose too much water





*allow plant may wilt*  
*ignore references to oxygen / carbon dioxide*  
*plants lose a lot of water is insufficient*  
*ignore flaccid*

1

(ii) any **one** from:

- hot
- dry
- windy

*ignore environments unqualified eg desert*

1

[6]

### 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.

#### **Level 3 (5–6 marks):**

Processes used for obtaining specified materials are given.

**and**

correctly linked to the vessels that the materials are transported in

**or**

correctly linked to a description of the direction of movement of the materials.

**For full credit**, in addition to the above descriptors at least **one** of the processes must be linked to the vessel that the material is transported in **and** the direction of the movement of the material.

#### **Level 2 (3–4 marks):**

At least **one** process for obtaining a specified material is given

**and**

is correctly linked to the vessel that the material is transported in

**or**

correctly linked to a description of the direction of movement of the material

#### **Level 1 (1–2 marks):**

At least **one** process (P) for obtaining a material is given

**or**

at least **one** vessel (V) and the material it carries is given

**or**

there is a description of the direction of movement (M) for at least **one** material

#### **0 marks:**

No relevant points are made

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

(P) taken up by diffusion or active transport

- from an area of high to low concentration (diffusion) **or** an area of low to high concentration (active transport)

(V) travels in the xylem

(M) to the leaves **or** from the roots / soil

#### **Water:**



(P) taken up by osmosis

- from an area of low to high concentration
  - allow high concentration of water to low concentration of water*
  - allow from high water potential to low water potential*
  - ignore along a concentration gradient*
- (V) travels in the xylem
- (M) to the leaves **or** from the roots / soil
- (P) transpiration stream
- movement replaces water as it evaporates from leaves
- (V) in the xylem

**Sugar:**

(P) made during photosynthesis

(V) travels in the phloem

(M) to other parts of the plant **or** to storage organs **or** travels up and down

[6]

