Mark schemes

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 ÷ 7 (in hours)
or
40 ÷ 420 (in minutes)

allow correct answer from student's readings throughout

1

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) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.

5–6

Level 2: Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

No relevant content

0

Indicative content

- (many) alveoli
  - provide a large(r) surface area (**:** volume)
- capillaries are thin
  - **or** alveoli / capillary walls are thin **or** one cell thick
  - **or** capillaries are close to the alveoli
  - which provides short diffusion path (for oxygen / carbon dioxide)
- breathing (mechanism) moves air in and out **or** lungs are ventilated
  - to bring in (fresh) oxygen
  - to remove carbon dioxide
  - to maintain a concentration / diffusion gradient
- large capillary network (around alveoli) **or** good blood supply
  - to remove oxygen(ated blood) quickly
  - to bring carbon dioxide to the lungs quickly
  - to maintain a concentration / diffusion gradient

(d) Osmosis

allow diffusion

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)

allow (to move nitrate ions) against / up the concentration gradient

allow (because) there is a lower concentration (of nitrate ions) in the soil
***or** (because) there is a higher*

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^3) 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^3)

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 × 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^3/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

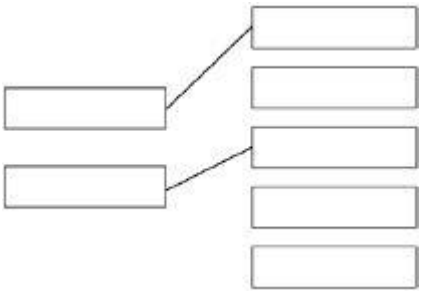
- (it was) windier

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_2O / H2O

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

1

(c) **Q**

1

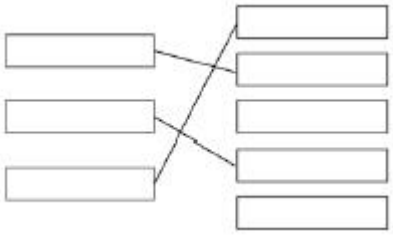
(d) guard cell

1

(e) a group of cells with a similar structure / function

1

(f)



1 *mark for each correct line*

extra line from a tissue negates the mark for that tissue

3

[10]

Q9.

(a) 86

allow this answer only

*do **not** accept 85.7*

if no answer given, check for answer in the table

1

(b) as salt concentration increases, percentage of open stomata (in field of view) decreases (above 0.1 mol / dm^3)

or

allow percentage of open stomata stays the same between 0.0 and 0.1 (mol / dm^3 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^3

1

(c) use concentrations between 0.3 (mol / dm^3) and 0.4 (mol / dm^3)

or

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^3), 0.34 (mol / dm^3), 0.36 (mol / dm^3) etc.

1

(d) ($\pi \times 0.1875^2$) = 0.11 (mm^2)

*an answer of 36 scores **3** marks*

1

$\frac{4}{0.11}$

1

36 (per mm^2)

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^2 (diameter used instead of radius)*

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

- *sight of area = 0.44(mm^2) (diameter used instead of radius)*
- *sight of number of open stomata = 9.1 / 9.05 / 9.06 per mm^2 (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]