

Mark schemes

Q1.

- (a) any **two** from:
- (microscope) slide
 - cover slip
 - dye / stain
- allow named dye / stain*
- ignore water*
- (mounted) needle
 - pipette / dropper
 - scalpel
- ignore knife*
- forceps / tweezers
- allow swab (to collect cells)*
- 2
- (b) eyepiece / lens
- do **not** accept objective lens*
- 1
- (c) to focus (the image / cells)
- allow to make the cells / image clear(er)*
- allow to improve resolution (of the image)*
- ignore to move the stage up / down*
- do **not** accept reference to magnification*
- 1
- (d) any **one** from:
- no cells in the field of view
 - slide not in the correct position
 - mirror not in correct position
- allow light / microscope not switched on / plugged in*
- (objective) lens not clicked into place
- or**
- (objective) lens dirty
 - (student is) looking at a (large) air bubble
 - (the microscope is) not focussed
- allow student did not stain the cells*
- allow idea of magnification not being high enough*
- 1
- (e) **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

No relevant content

0

Indicative Content

Differences:

- red blood cell has no nucleus **or** plant cell has a nucleus
- red blood cell has no cell wall **or** plant cell has a cell wall
- red blood cell is a biconcave disc **or** there are many different shapes of plant cell
- red blood cell contains haemoglobin **or** plant cells do not contain haemoglobin
- red blood cells do not contain chlorophyll **or** plant cells (may) contain chlorophyll
- red blood cell has no chloroplasts **or** plant cell has chloroplasts
- red blood cell has no (permanent) vacuole **or** plant cell has (permanent) vacuole
- red blood cells are (much) smaller than plant cells

Similarities:

both have:

- cytoplasm
- cell membrane
- pigments (although they are different)

ignore references to mitochondria and ribosomes

for **Level 2**, consideration of both red blood cells and plant cells is required.

- (f) water enters (the cells) by osmosis / diffusion

*allow water enters **and** the cell starts to swell*

ignore explanations of osmosis

1

plant cell has a cell wall (which prevents it from bursting)

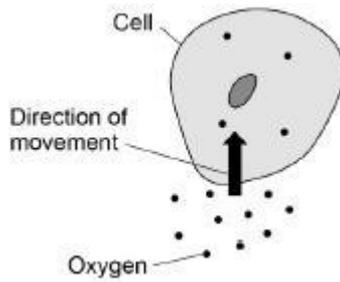
allow red blood cell has no cell wall (so it swells and bursts)

1

[13]

Q2.

(a)



1

(b) water

in this order only

1

mineral ions

allow minerals / ions

1

energy

1

(c) root hair (cell)

ignore root / hair unqualified

1

(d) large surface / area

allow it has a long projection

allow the walls are thin

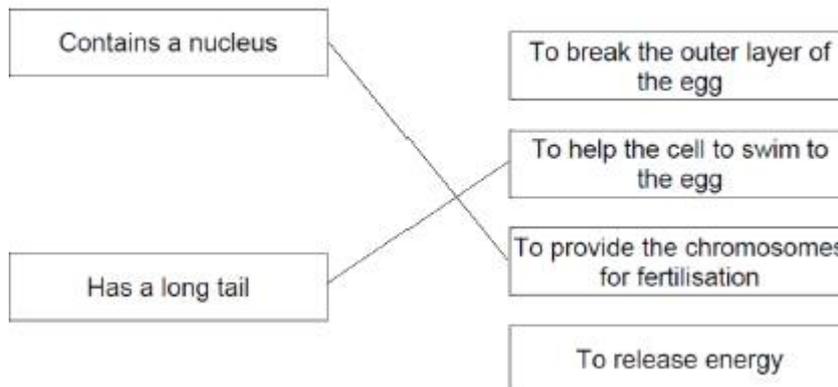
allow it has lots of mitochondria

1

(e)

Feature of sperm cell

How the feature helps



1

do **not** accept more than one line from a box on the left

1

(f) nerve (cell)

allow neuron(e)

ignore motor / sensory / relay

1

any **one** from:

- long
- has branches
- has insulation

allow myelin / fat

1

[10]

Q3.

(a) any **two** from:

- sterilise equipment / surfaces (before use)
- (use) sterilised agar

ignore 'clean' unqualified

ignore wash hands

allow description of how to sterilise equipment

allow description of how to sterilise agar

- secure lid of the Petri dish with (adhesive) tape
- only lift lid of Petri dish a little (when setting up plate) **or** lift lid of Petri dish at an angle (when setting up plate)

2

(b) B

and

it kills the fewest bacteria

or

it has the smallest area where no bacteria were growing

allow it has the smallest clear / white area

an incorrect answer for one step does not prevent allocation of marks for subsequent steps

ignore calculation and subtraction of filter paper disc area from total area

1

(c) (correct measurement)

Note: In Exampro, the measurement of 1.1 cm or 2.2. cm will depend on the printing of the exported diagram and should therefore be checked by the teacher/student using this mark scheme.

$r = 1.1$ (cm)

or

$r = 11$ (mm)

allow $d = 2.2$ (cm)

or

$d = 22$ (mm)

allow a tolerance of ± 1 mm

1

(recall of the equation)

$$\pi r^2$$

1

(calculation/substitution)

$$3.14 \times 1.1^2$$

or

$$3.14 \times 11^2$$

*allow correct calculation / substitution
using an incorrect measurement*

1

$$= 3.799(4) \text{ (from } 3.14 \times 1.1^2)$$

or

$$= 379.9(4) \text{ (from } 3.14 \times 11^2)$$

allow 3.8

allow 380

1

correct unit

$$(3.7994) \text{ cm}^2$$

or

$$(379.94) \text{ mm}^2$$

*do **not** accept unit with no attempt at
working / answer*

1

(d) any **one** from:

- repeat **and** calculate a mean
- repeat **and** eliminate anomalies
- use a control disc

*allow description of control disc e.g.
disc with water / nothing ignore set up a
control*

- use different types of bacteria

1

[9]

Q4.

(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

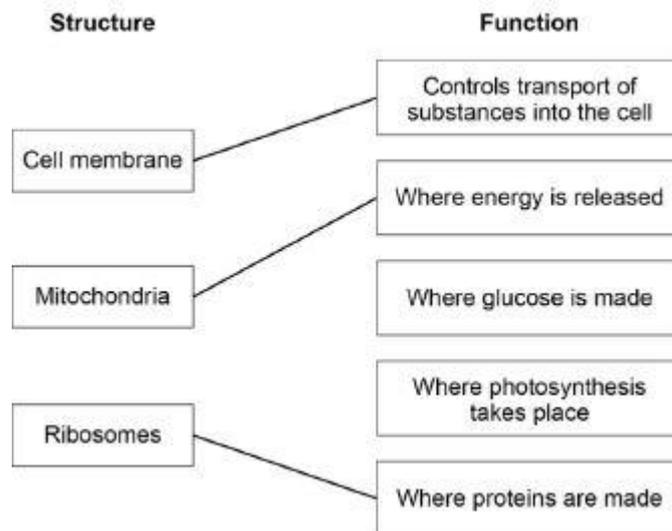
For **Level 2**, students must refer to both structure and function of xylem and phloem tissue.

- (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]

Q5.

- (a) bacterium 1
- (b) to strengthen the cell 1
- (c) chloroplast 1
- (d)



additional line from a box on the left negates the mark for that box

- 3
- (e) adjust the focus knob 1
- (f) (A =) 15 (mm)
allow a tolerance of ± 1mm 1
- (B =) 60 (mm) 1
- (g) $\frac{60}{15} = 4(.0)$
allow ecf from question (f) 1
- (h) $\frac{40}{0.1}$ 1
- 400
do not accept if a unit is given 1
- [12]**

Q6.

- (a) any **two** from: (both have)
- cytoplasm
 - (cell) membrane
 - DNA / genetic material
- ignore reference to shape*

- allow RNA*
ignore genetic information
- ribosomes
 - if no other mark awarded allow sub-cellular structures for 1 mark*
 - if no other mark awarded allow correct cellular process, e.g. respiration for 1 mark*
- 2
- (b) any **three** from:
- allow converse for eukaryotic cells*
 - allow reference to bacterium instead of prokaryotic cell*
 - ignore reference to features not shown in the diagram*
 - prokaryotic cell is smaller
 - prokaryotic cell has no mitochondria
 - prokaryotic cell has no nucleus
 - or** DNA is free in the cytoplasm
 - or** genetic material is free in the cytoplasm
 - if neither mark awarded, allow prokaryotic cell has no membrane-bound organelles*
 - ignore genetic information*
 - prokaryotic cell has a single loop of DNA
 - or** prokaryotic cell has a single loop of genetic material
 - ignore genetic information*
 - prokaryotic cell has plasmids
 - ignore circular / rings of DNA*
 - allow prokaryotic cells have smaller ribosomes*
- 3
- (c) $1\ \mu\text{m} = 0.001\ \text{mm}$
or $1\ \text{mm} = 1000\ \mu\text{m}$
or $0.05\ \text{mm} = 50\ \mu\text{m}$
or 0.05×1000
- 1
- (1:) 50
- do **not** accept if a unit is given*
- 1
- (d) mitosis
- correct spelling only*
- 1
- (e) 35%
- 1
- (f) (stage 1)

- DNA / chromosomes replicate / duplicate
ignore names of the stages of the cell cycle
ignore genetic material ignore DNA / chromosomes double / reproduce
 1
- mitochondria / ribosomes / sub-cellular structures increase in number
or mitochondria / ribosomes / sub-cellular structures replicate
allow cytoplasm increases
ignore cell grows unqualified
 1
- (stage 2)
 one set of chromosomes is pulled / moved to each end of the cell
allow one of each chromosome is pulled / moved to each end of the cell
ignore nucleus divides
 1
- (stage 3)
 the cytoplasm **and** cell membrane divides (to form two cells)
*allow cytoplasm divides **and** (new) cell membranes form ignore nucleus divides*
 1
- [13]**

Q7.

- (a) controls the (activities of the) cell
allow contains genetic information / genes / DNA / chromosomes
*do **not** accept brain*
*do **not** accept controls substances entering / leaving the cell*
 1
- (b) red blood cell / RBC
allow erythrocyte
ignore blood cell unqualified
ignore platelets
or
 bacteria / prokaryote
allow named examples of bacteria
*do **not** accept virus*
or
 xylem (cell)
 1
- (c) cell shape is similar to cell in **Figure 1 and** nucleus present
ignore shading
*do **not** accept a cell wall drawn*
 1

any **two** features correctly identified and labelled:

- nucleus
- (cell) membrane
- cytoplasm
- mitochondria / mitochondrion
- ribosome(s)

allow cell wall if drawn and correctly labelled

*do **not** accept other plant sub-cellular structures*

1

(d) any **one** from:

- (cellulose cell) wall
 - chloroplast
 - (permanent) vacuole
- ignore chlorophyll*
allow starch grain

1

(e)

*an answer of (x) 400 scores **3** marks*

*an answer of (x) 40 scores **2** marks*

24 (mm) **or** 2.4 (cm)

*allow in range 23 to 25 (mm) **or** in range 2.3 to 2.5 (cm)*

1

$$\frac{24}{0.06}$$

or

$$\frac{2.4}{0.06}$$

*allow correct calculation from their measurement of **X** to **Y** in the range 2.3 cm to 3.5 cm **or** 23 mm to 35 mm*

1

(x) 400

*allow correct magnification derived from their measurement in **mm***

ignore rounding errors

1

(f) high(er) magnification

ignore bigger / zoom

*if neither mark awarded allow **1** mark for see smaller objects **or** see smaller sub-cellular structures*

1

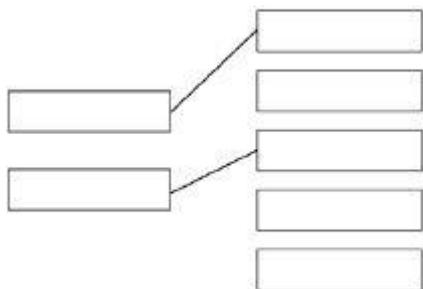
high(er) resolution **or** high(er) resolving power

*allow see more detail
if neither mark awarded allow 1 mark for
see smaller objects **or** see smaller
sub-cellular structures
allow 3D image*

1
[10]

Q8.

(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

[7]

Q9.

(a)

x	✓	✓
✓	x	✓

1 mark for each correct row if no other marks awarded allow a mark for one correct column

2

(b) a bacterial cell

1

(c) make / synthesise / produce protein
allow produce enzymes

1

(d) 0.0015 (mm)
allow 1.5×10^{-3} (mm)

1

(e) mitochondria are longer / bigger (than the cell)
allow too big

1

(f)

2⁴

*an answer of 16 scores 2 marks
allow $2 \times 2 \times 2 \times 2$ or a correct list showing doubling at each time interval*

1

16

allow 90 mins = 8 for 1 mark

1

(g) (number of live cells / bacteria) stays level / the same until 11 hours
answer must refer to number of live cells / bacteria
(not the shape of the graph)
allow (number of cells / bacteria) is very low until 11
hours allow number in the range 10-11 hours 1

then (number of live cells / bacteria) increases rapidly to 2.5×10^8
or
 from 11 hours to 14.5 hours
allow (then) increases exponentially 1

then (number of live cells / bacteria) stays at 2.5×10^8
allow (number of live cells / bacteria) stays the
same for the next 5 hours
or
 stays the same from 15 to 20.5 hours
if no other mark awarded allow for 1 mark the idea
that the graph is level, then increases, then levels
off again 1

(h) any **one** from:

- lack of food / nutrients / oxygen / space
or
 competition for space
- build-up of toxins
allow ethanol
- temperature too high

1
[12]

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

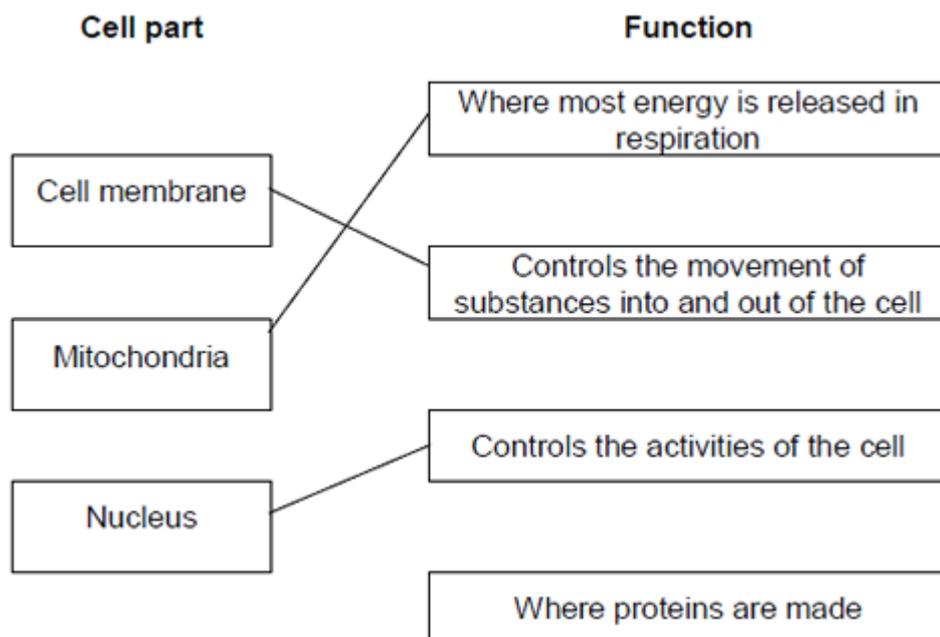
- allow (vacuole contains) cell sap that is more concentrated than soil water (1)* 1
- for more / faster osmosis
create / maintain concentration / water potential gradient (1)
- or**
- allow thin (cell) walls
for short(er) diffusion distance 1
- (d) (on hot day) more water lost
allow converse for a cold 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) nucleus labelled correctly 1
- cell membrane labelled correctly 1
- (b) mitosis 1
- (c) electron (microscope)

- | | | |
|-----|---|------------|
| | | 1 |
| (d) | higher magnification | 1 |
| (e) | 45 (mm) | 1 |
| | 45 / 250 or 0.18 (mm)
<i>allow ecf</i> | 1 |
| | 180 (µm) | 1 |
| | <i>allow 180 (µm) with no working shown for 3 marks</i> | |
| (f) | 0.2 µm | 1 |
| | | [9] |

Q12.



- | | | |
|-----|----------------------------------|------------|
| (a) | <p><i>extra lines cancel</i></p> | 3 |
| (b) | Cell wall | 1 |
| | <i>in either order</i> | |
| | Chloroplast | 1 |
| | <i>allow (permanent) vacuole</i> | |
| | | [5] |