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)

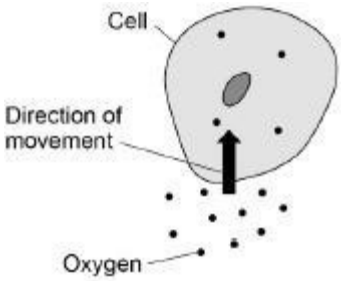
allow red blood cell has no cell wall (so it swells and bursts)

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

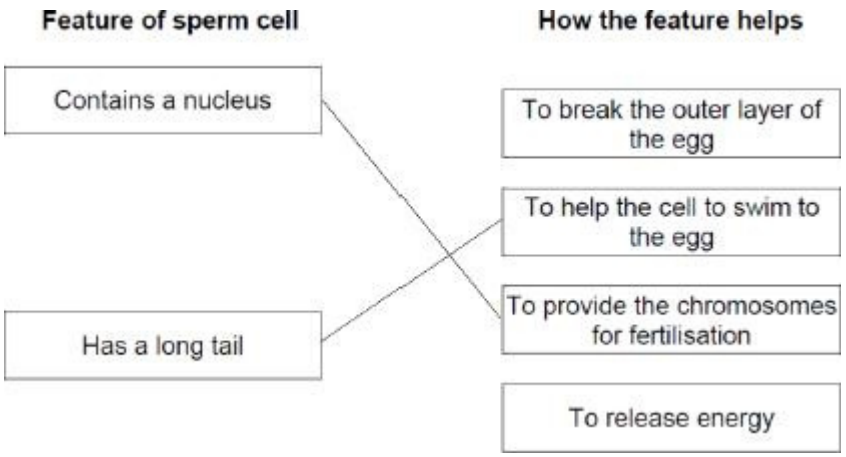
1

(d) large surface / area

allow it has a long projection
allow the walls are thin
allow it has lots of mitochondria

1

(e)



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)
πr^2

1

(calculation/substitution)
3.14 x 1.12
or
3.14 x 112

allow correct calculation / substitution using an incorrect measurement

1

= 3.799(4) (from 3.14 x 1.12)
or
= 379.9(4) (from 3.14 x 112)

allow 3.8
allow 380

1

correct unit
(3.7994) cm2
or
(379.94) mm2

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) x 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

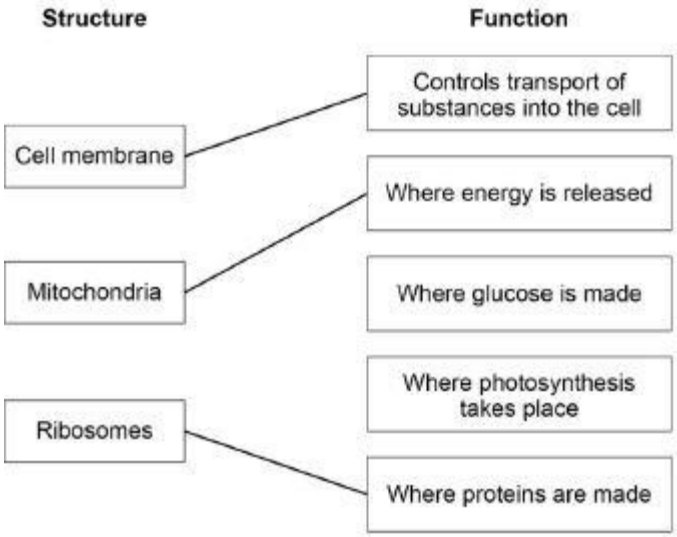
(b) to strengthen the cell

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 µm = 0.001 mm
or 1 mm = 1000 µm
or 0.05 mm = 50 µm
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

ignore chlorophyll
- (permanent) vacuole

allow starch grain

1

(e)

an answer of (×) 400 scores 3 marks
an answer of (×) 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

2.4

$\overline{0.06}$

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

(×) 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

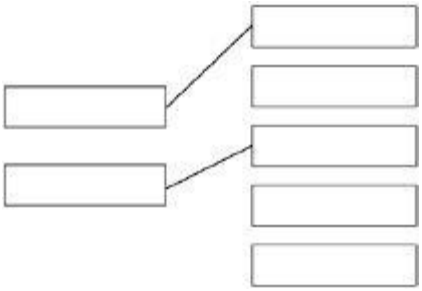
allow see more detail
if neither mark awarded allow 1 mark for see smaller objects or see smaller sub-cellular structures
allow 3D image

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

(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]

Q9.

(a)

×	✓	✓
✓	×	✓

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 × 2 × 2 × 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 × 108
or
from 11 hours to 14.5 hours

allow (then) increases exponentially

1

then (number of live cells / bacteria) stays at 2.5 × 108

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)

allow ecf

1

180 (µm)

1

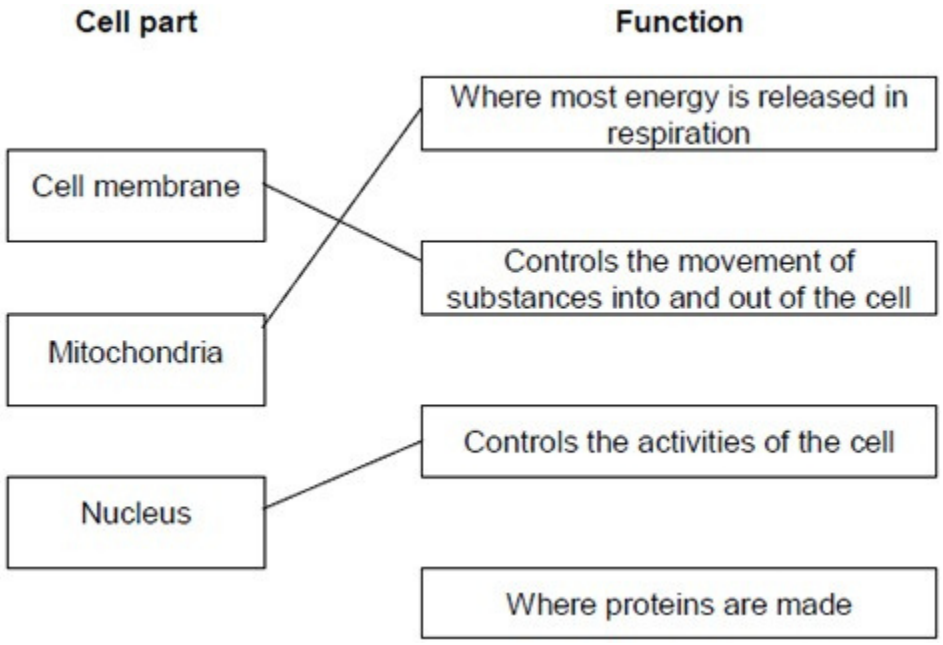
allow 180 (µm) with no working shown for 3 marks

(f) 0.2 µm

1

[9]

Q12.



(a)

extra lines cancel

3

(b) Cell wall

in either order

1

Chloroplast

allow (permanent) vacuole

1

[5]