

Mark schemes

Q1.

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)

An example is given of a named substance

or

a process

or

there is an idea of why diffusion is important eg definition.

Level 2 (3 – 4 marks)

At least one example of a substance is given

and

correctly linked to a process in either animals or plants.

Level 3 (5 – 6 marks)

There is a description of a process occurring in either animals or plants that is correctly linked to a substance

and

a process occurring in the other type of organism that is correctly linked to a substance.

examples of points made in the response

Importance of diffusion:

- to take in substances for use in cell processes
- products from cell processes removed

Examples of processes and substances:

- for gas exchange / respiration: O₂ in / CO₂ out
- for gas exchange / photosynthesis: CO₂ in / O₂ out
- food molecules absorbed: glucose, amino acids, etc
- water absorption in the large intestine
- water lost from leaves / transpiration
- water absorption by roots
- mineral ions absorbed by roots

extra information

Description of processes might include:

- *movement of particles / molecules / ions*
- *through a partially permeable membrane*
- *(movement of substance) down a concentration gradient*
- *osmosis: turgor / support / stomatal movements*

Q2.

(a) award **3** marks per tube for each key idea
for tube 1:
expands **or** gets firmer **or** bigger **or** inflates
it gains water
because the concentration of water is less than its surroundings
make sure answer is about water movement and not sucrose solution

3

for tube 2
gets floppy **or** flaccid **or** contracts
it loses water
because the concentration of water is greater than its surroundings

3

(b) any **2** from:
uptake of water by root (hair) **or**
movement from cell to cell within
plant
*do **not** credit references to diffusion unless it is clear that the candidate is referring to the diffusion of water*

guard cell function
maintain turgor
water absorption in the large intestine
reabsorption of water from the
nephron **or** collecting duct or in
kidney **or** osmoregulation in kidney

allow osmosis in other animals if some use is shown

2

[8]

Q3.

- (a) (i) A
(ii) B

for 1 mark each

2

(b) diffusion
*(reject osmosis)
for one mark*

1

(c) C
because uptake against a concentration / diffusion gradient
*(reject osmosis)
(if C not given, then idea of movement essential)*

for 1 mark each

2

[5]

Q4.

- (a) (cell) wall
(cell) membrane
cytoplasm
vacuole

for 1 mark each

4

- (b) (i) A

- (ii) B

for 1 mark each

2

- (c) diffusion (reject osmosis)

for 1 mark

1

[7]

Q5.

- (a) movement of water [1]

from high concentration (of water) to low concentration (of water)

or

from (an area of) dilute solution to an area of concentrated solution [1]

through a differentially **or** partially **or** selectively **or** semi permeable membrane [1]

3

- (b) (i) it will rise

1

- (ii) water enters visking tubing [1]

because the concentration of water outside is greater than the concentration inside

or

because the concentration of salt **or** solute is greater inside the tubing than outside [1]

or

to equalise concentration water has to enter visking tubing [2]

2

[6]

Q6.

- (a) **award one mark for each key idea**

energy released **or** energy transferred **or** respiration

*allow provides **or** gives*

*do **not** allow produces **or** makes*

3

near to the site of movement **or**
energy available quickly **or** more
energy

accept allows more mitochondria to fit in

(mitochondria) packed (around
filament) **or** efficient arrangement **or**
spiral arrangement

- (b) contains chromosomes **or** genes **or**
DNA

***not** genetic material*

1

(which) contribute half (the genes) to
the fetus **or** offspring

*23 chromosomes **or** half the genes
or reference to X,Y chromosome determining sex (if the
notion of halfness is there)
nucleus contains half genes for the offspring = 2 marks*

1

[5]

Q7.

- (a) (i) haemoglobin / oxyhaemoglobin
must be phonetic

1

- (ii) carries oxygen **or** forms oxyhaemoglobin
*Ignore references to CO₂/ iron
cancel if extras like food / glucose*

1

from lungs to tissues

1

- (b) no nucleus **or** biconcave disc (described)
*ignore references to size
ignore vague references to being
'round' / 'donut' shaped etc.*

1

[4]

Q8.

- (a) B

no mark for ÉBÉ, alone

large(r) surface / area **or** large(r) membrane
*accept reference to microvilli
accept reasonable descriptions of the surface
do **not** accept wall / cell wall
ignore villi / hairs / cilia*

1

- (b) (i) any **one** from:

- insulin / hormone
if named hormone / enzyme must be correct for pancreas
- enzyme / named enzyme

1

(ii) many ribosomes

1

(ribosomes) produce protein

accept insulin / hormone / enzyme named is (made of) protein

or

allow many mitochondria (1)

provide energy to build protein **or** to make protein (1)

accept ATP for energy

1

[4]

Q9.

(a) A cytoplasm

1

where (chemical) reactions take place

do not accept where cell functions take place

1

or

carries/holds the organelles/named organelles / named chemicals (including nutrients)

do not accept keeps the shape of the cell

or

contains water

or

presses out on the membrane

allow: keeps cell turgid

allows transport through the cell

B membrane

do not accept by themselves:

protects cell

gives shape

1

controls what enters/leaves the cell

1

or

contains the cell/holds the cell together

do not accept keeps harmful substances out

or

allows movement into and out of the cell C nucleus 1

contains the genetic material/DNA/genes/chromosomes

do not accept:
brain of the cell
stores information/instructions
tells cell what to do

or
controls (the activity) of the cell 1

- (b) (i) one mark for each correctly labelled part
cell wall
do not accept anything inboard of the inner edge vacuole
accept anything inboard of transplast

chloroplast: site of photosynthesis/ for photosynthesis
accept word equation or balanced equation 1

cell wall: supports the cell/keeps the shape/keeps it rigid
do not accept protects the cells 2

- (ii) vacuole: acts as reservoir for water / chemicals/(cell)/sap 3

or
keeps cell turgid/pushes content to edge

or
maintains concentration gradient

or
allows cell elongation (not growth) 1

[12]

Q10.

- (a) **A** = nucleus
accept phonetic spelling only 1

B = (cell) membrane
accept plasma membrane 1

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

photosynthesis

makes sugar / starch / carbohydrate / organic material

accept 'makes food'
do not accept makes chlorophyll
ignore stores starch / food / light / chlorophyll

traps or absorbs light

1

(c) any **two** from:

Plant cell

Animal cell

- | | |
|--|--|
| • (has) vacuole or has cell sap | • no vacuole or small/temporary vacuole or no cell sap |
| • (has) wall/cellulose | • no wall/cellulose or <u>only</u> membrane |
| • (stores) starch or doesn't store glycogen | • doesn't store/have starch or stores glycogen |

*ignore reference to shape
must be clear indication in all four boxes
ignore reference to chlorophyll*

2

[5]

Q11.

(a) any **three** from:

- (water through a) partially permeable
accept 'semi permeable' / selectively permeable
- membrane
- from dilute to (more) concentrated solution
*allow 'from a high concentration of water to a lower concentration (of water)'
allow 'from high water potential to low water potential'
allow 'down a concentration gradient of water'
do **not** accept 'along a concentration gradient of water'*
- (it's a) passive (process)
allow requires no energy

3

(b) (there are) many hairs **or** thin hairs **or** hairs are one cell thick

1

(which gives) large / increased surface area **or** short diffusion pathway

1

(so there is) more diffusion / osmosis (of water into the root)

ignore absorption

1

[6]

Q12.

(a) because water enters (the cell / it / named cell)

*do **not** accept salt / sugar / solution entering*

1

by osmosis / diffusion

if osmosis / diffusion not given accept concentration inside cell greater than outside cell

assume concentration refers to solute concentration unless answer indicates otherwise

allow water goes up the concentration gradient

allow water goes down its concentration gradient

*do **not** accept if diffusion of salt / sugar*

1

through a partially permeable membrane

*allow semi / selectively permeable membrane **or** description*

1

(b) (plant cells) have (cell) wall

accept animal cells have no (cell) wall

ignore reference to cell membrane

*do **not** accept reference to other organelles **or** any*

implication that animal cells have a cell wall eg plant cells

have a thicker cell wall

1

[4]

Q13.

(a) (i) release energy

allow provide / supply / give energy

*do **not** accept produce / create / generate / make energy*

*do **not** allow release energy for respiration*

1

(ii) contain half the (number of) chromosomes **or** contains one set of chromosomes **or** contains 23 chromosomes

allow genetic information / DNA / genes / alleles instead of chromosomes

accept haploid

1

(b) any two from:

• (stem cells) are unspecialised / undifferentiated

allow description eg 'no particular job'

• are able to become differentiated

or can form other types of cell / tissue / organ

• stem cells can / able to divide / multiply

2

[4]

Q14.

(a) (i) makes / produces / synthesises protein / enzyme

1

(ii) plant cell has nucleus / vacuole / chloroplasts / chlorophyll **or** plant cell is much larger

'It' = plant cell

allow correct reference to DNA or chromosomes

allow plant cell has fewer ribosomes

allow cellulose (cell wall)

1

(b) (i) 200

correct answer with or without working gains 2 marks

*if answer incorrect, allow 1 mark for $\frac{2 \times 50,000}{500}$ or $\frac{100,000}{500}$
or 100*

2

(ii) bacterial cell is too small / bacterial cell about same size as a mitochondrion / 'no room'

ignore references to respiration

1

[5]

Q15.

(a) an undifferentiated / unspecialised cell

1

that can differentiate / become / change into (many) other cell types

1

(b) (malignant tumours) invade / spread to other tissues via the blood (benign don't)
or

(malignant tumours) form secondary tumours in other organs

ignore cancer unqualified

allow converse

allow metastasises

1

(c) mitosis

correct spelling only

1

(d) glucose

answers in any order

ignore sugar

1

protein / amino acids

1

(e) no need to wait for a donor

or

can be done immediately

1

(so) no risk of rejection

or

no need for immunosuppressant drugs

*if no other marks awarded, allow for 1 mark idea of ethics
surrounding the use of tissue from another / dead person*

1

(f) stent opens up the trachea

1

allowing air to flow through

or

allowing patient to breathe

1

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

A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

Level 2 (3-4 marks):

Some logically linked reasons are given. There may also be a simple judgement.

Level 1 (1-2 marks):

Relevant points are made. They are not logically linked.

Level 0

No relevant content

Indicative content

embryos advantages

- can create many embryos in a lab
- painless technique
- can treat many diseases / stem cells are pluripotent / can become any type of cell (whereas bone marrow can treat a limited number)

embryos disadvantages

- *harm / death to embryo*
- *embryo rights / embryo cannot consent*
- *unreliable technique / may not work*

bone marrow advantages

- no ethical issues / patient can give permission
- can treat **some** diseases
- procedure is (relatively) safe / doesn't kill donor
- tried and tested / reliable technique
- patients recover quickly from procedure

bone marrow disadvantages

- *risk of infection from procedure*
- *can only treat a few diseases*
- *procedure can be painful*

both procedures advantage

can treat the disease / problem

both procedures disadvantages

- *risk of transfer of viral infection*
- *some stem cells can grow out of control / become cancerous*

[16]

Q16.

(a) diffusion

1

active transport

1

this order only

(b) (i) concentration (of sugar) in the bag was higher (than in the drink)

allow concentration (of sugar) in the drink was lower (than in the bag)

or

higher concentration of water outside the bag **or** in the drink / boiling tube
*allow higher water potential outside the bag **or** lower water potential inside the bag*

1

(so) water moved in (to the tubing)

*allow water moves down **its** concentration gradient
do **not** allow sugar moving*

1

by osmosis

allow diffusion (of water)

*do **not** allow sugar moving by osmosis **or** water moving by active transport*

1

(ii) **B**

1

(iii) close(st) to the concentration in the bag **or** to 5%

*allow small(est) diffusion gradient **or** close(st) to an equilibrium*

1

(so rate of) diffusion / osmosis is slow

*allow (so) less water moves in (to the bag)
ignore ref. to sugar*

1

[8]

Q17.

(a) (i) diffusion

1

(ii) carbon dioxide

*accept CO₂ / CO₂
do **not** accept CO²*

1

(iii) red blood cells

1

(b) 70

*if no / incorrect answer then
70 000 000
or
280 x 0.25 gains 1 mark
ignore doubling the answer*

2

(c) allows more gas / oxygen / CO₂
(exchange)

do not accept air

1

[6]

Q18.

(a) (i) nucleus

1

(ii) diffusion

1

(b) increases / larger surface area (for diffusion)

ignore large surface area to volume ratio

1

(c) (i) sugar / glucose

accept amino acids / other named monosaccharides

1

(ii) against a concentration gradient

or

from low to high concentration

1

(iii) (active transport requires) energy

1

(from) respiration

1

(d) minerals / ions

accept named ion ignore nutrients

do not accept water

1

[8]

Q19.

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]

Q20.

- (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)

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

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

(×) 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]

Q21.

(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]

Q22.

(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]

Q23.

- (a) (surface area =) 24 (cm²) 1
- (b) (volume =) 8 (cm³) 1
- (c) 3 (:1)
allow ecf from (a) and (b) 1
- (d) to keep the volume (of the cubes) the same in both sets
allow to compare with the 2 × 2 × 2 cube
or

so both sets of cubes are 8 cm³

ignore to keep it fair

1

(e) so that excess water does not contribute to the mass of the cubes

1

(f) 0.8 (g)

if no answer given, check for answer in the table

1

(g) (because) water moved into the cubes (by osmosis)

allow water moves in by diffusion

1

because the solution outside the cubes was more dilute than inside the cells

allow converse

*allow because the concentration of water was higher outside
the cubes / in the beaker / solution than inside the cells*

1

(h) because the samples of cubes were different masses at the start of the investigation

1

(i) more water was taken in

allow ecf for answer to (d)

1

because they had a larger surface area to volume ratio

allow more / faster osmosis happened

1

[11]