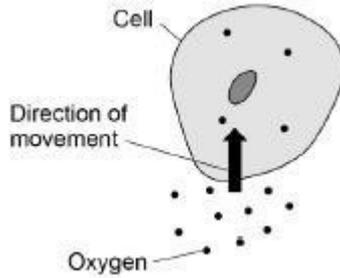


Mark schemes

Q1.

(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

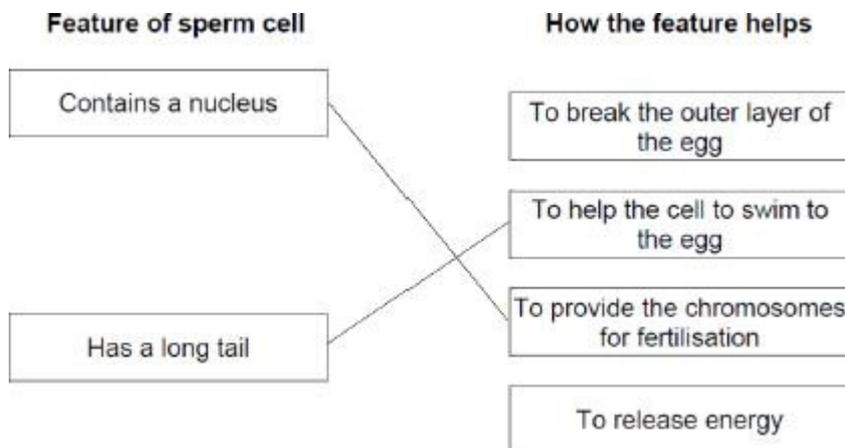
1

(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]

Q2.

(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

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) rice

1

(b) 25 (%)

*allow an answer between 23 and 27 (%)
ignore ¼ / 0.25*

1

(c) (beans) contain all (four) food groups

allow converse for chicken

allow chicken contains no / less carbohydrate or beans contain carbohydrate

allow beans contain more nutrients

ignore references to water / fat / protein

1

- (d) amylase 1
- (e) Benedict's reagent 1
- (f) (brick) red / green / yellow / orange / brown 1
- (g) C 1
- (h) small intestine
allow ileum
ignore intestine unqualified
do not accept large intestine / duodenum 1
- (i) active transport 1
- osmosis 1
- [10]

Q5.

- (a) the movement of particles from a high concentration to a low concentration 1
- (b) (gills) have (many) projections
allow description of projections
allow have lots of / five gills 1
- (for) large(r) surface / area
or
(gills) are on the outside of the body (1)
for good access to water (1) 1
- (c) differentiation 1
- (d) mitosis
do not accept meiosis 1
- (e) hair 1
- (f) axolotls are cheap to feed 1

- axolotls are easy to breed 1
- (g) D 1
- (h) trachea
allow windpipe
allow cartilage (ring) 1
- (i) pulmonary artery 1
- [11]

Q6.

- (a) protein 1
- (b) urea is a waste (product)
allow toxic / poisonous or may damage cells or denatures proteins
ignore harmful / dangerous 1
- (c)
in this order
- respiration 1
- breathing 1
- (d)
in this order
- least
- medium
- most
- 3 correct = 2 marks*
1 or 2 correct = 1 mark 2
- (e) diffusion 1
- (f) protein 1

(molecules too) large

this mark may only be awarded if mp1 is correct or not attempted

- allow pores in membrane are too small* 1
- (g) 3
allow three 1
- (h) increases
ignore numbers 1
- (i) any two from:
allow converse points for person A / dialysis
 - has a low(er) concentration of urea
 - constant urea concentration / level
allow substance (if named must be correct)
 - less time attached to machine or fewer hospital visits
 - no / less restriction on travel
 - not piercing skin repeatedly
 - less chance of infection / blood clots
 - cheaper in the long term
ignore cheaper unqualified
 - no restrictions on diet
 2
 [13]

Q7.

- (a) diffusion 1
- (b) A 1
- (c) B 1
- (d) (earthworm) can absorb more oxygen (in a given time)
or
increases / more gas exchange
allow get / obtain / take in more oxygen
ignore easier absorption of oxygen
ignore references to food 1
- (e) lipase 1
- (f) more oxygen (in soil with earthworms)
allow earthworms bring oxygen to soil 1
- (for) more (aerobic) respiration

do not accept anaerobic respiration

1

(of) bacteria / fungi / microorganisms / microbes / decomposers

1

*reference to more is only needed once
for the first two marking points*

(g) fertilisation

ignore sexual reproduction

1

(h) asexual (reproduction)

allow cloning

1

[10]

Q8.

(a) (yes, because) the mass change (of egg 4) is much lower than the others

*allow because it / egg 4 has gained
(over) 50% less mass than the others
allow it / egg 4 has gained 1.5 g and the
others have all gained more than 3 g
(unit required)*

1

(b) $\frac{75.7 - 72.4}{72.4} \times 100$

or equivalent

1

4.6 (%)

*allow 4.558 / 4.56 (%)
allow any correct rounding of
4.558011049723757*

*an answer of 4.6 / 4.56 / 4.558 scores 2
marks*

1

(c) (mass increased because) water entered by osmosis

1

from a dilute solution in the beaker to a more concentrated solution in the egg (cell)

*allow from an area of high water
concentration in the beaker to an area
of low water concentration in the egg
(cell)
allow ref to water potential
allow ref to 'strong' and 'weak' solutions
ignore along / across concentration
gradient*

do not accept 'amount' in place of concentration

through a partially permeable membrane

allow semi-permeable / selectively permeable membrane

1

- (d) use five (or more) different concentrations of salt / sugar solution (in beakers)

allow any number of concentrations provided it is more than four

1

(by) plotting percentage change (in mass / volume) on / using a graph

1

determine the concentration where the curve / line crosses the zero percentage change (in mass / volume)

1

- (e) (ions are moved) from an area of low concentration to high concentration

*allow against the concentration gradient
allow in terms of solution do not accept molecules*

1

(by) active transport

1

(which) requires using energy

do not accept idea of energy being created

1

[12]

Q9.

- (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]

Q10.

- (a) movement of particles from (an area of) high concentration to (an area of) low concentration
allow movement of particles down a concentration gradient
do not accept along / across a concentration gradient
1
- (b) oxygen
allow O₂

carbon dioxide
allow CO₂
in this order only
both needed for 1 mark
1
- (c) less diffusion

	<i>allow less gas will enter / leave the blood</i> <i>allow ecf from (b)</i>	1
	(because of the) reduced / smaller surface area	1
(d)	(B) very low birth mass	1
	(C) extremely low birth mass	1
(e)	any one from: <ul style="list-style-type: none"> • men would be included in the study (can't be pregnant) • children / older (post-menopausal) women would be included in the study <i>ignore reference to cost</i>	1
(f)	any three from: <ul style="list-style-type: none"> • higher percentage of pregnant women have never smoked (compared with non-pregnant women) • higher percentage of pregnant women are ex-smokers (compared with non-pregnant women) • lower percentage of pregnant women currently smoke (compared with non-pregnant women) in both pregnant and non-pregnant women, the highest percentage of women have never smoked <i>allow converse throughout</i> <i>allow appropriate use of correct figures throughout</i>	3
(g)	scatter graph	1
(h)	B	1
(i)	there is no correlation (between the variables) <i>allow (all) the points are widely scattered</i> <i>allow idea that the person with the longest birth time does not have the highest risk</i>	1
		[13]
 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) $(0.15 / 1.35) \times 100$
- 1
- 11.1 (%)
- allow 11.1 (%) with no working shown for 2 marks*
- 1
- (b) to allow results to be compared
or
they had different masses at the start
- 1
- (c) axis correct scale and labelled
- 1
- 5 points correctly plotted
- allow ecf from 05.1*
- allow 1 mark for 4 points correctly plotted*
- 2
- line of best fit
- 1
- (d) 0.5

	<i>allow 0.45–0.55</i>	1
(e)	(0.0 to 0.4) water moves into cells	1
	(0.6 to 0.8) water leaves cells	1
	by osmosis	1
(f)	any two from:	
	• concentration of solutions	
	• drying of chips	
	• accuracy of balance	
	• evaporation from tubes	2
		[13]

Q13.

Level 3 (5–6 marks):

A detailed and coherent explanation is provided with most of the relevant content, which demonstrates a comprehensive understanding of the human circulatory system. The response makes logical links between content points.

Level 2 (3–4 marks):

The response is mostly relevant and with some logical explanation. Gives a broad understanding of the human circulatory system. The response makes some logical links between the content points.

Level 1 (1–2 marks):

Simple descriptions are made of the roles of some of the following: heart function, gas exchange, named blood vessels, named blood cells. The response demonstrates limited logical linking of points.

0 marks:

No relevant content.

Indicative content

- dual / double circulatory system which means that it has higher blood pressure and a greater flow of blood to the tissues
- heart made of specialised (cardiac) muscle cells which have long protein filaments that can slide past each other to shorten the cell to bring about contraction for pumping blood
- heart pumps blood to lungs in pulmonary artery so that oxygen can diffuse into blood from air in alveoli
- blood returns to heart via pulmonary vein where muscles pump blood to the body via aorta
- oxygen carried by specialised cells / RBCs which contain haemoglobin to bind oxygen and have no nucleus so there is more space available to carry oxygen
- arteries carry oxygenated blood to tissues where capillaries deliver oxygen to cells for respiration and energy release
- thin walls allow for easy diffusion to cells

- large surface area of capillaries to maximise exchange
- waste products removed eg CO₂ diffuse from cells into the blood plasma
- blood goes back to the heart in veins which have valves to prevent backflow
- cardiac output can vary according to demand / is affected by adrenaline

accept annotated diagrams

[6]

Q14.

(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]

Q15.

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
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):

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

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

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

Level 1 (1–2 marks):

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

at least

or

one material

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

No relevant points are made

0 marks:

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]