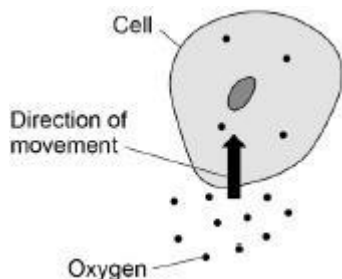


Mark schemes

**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*

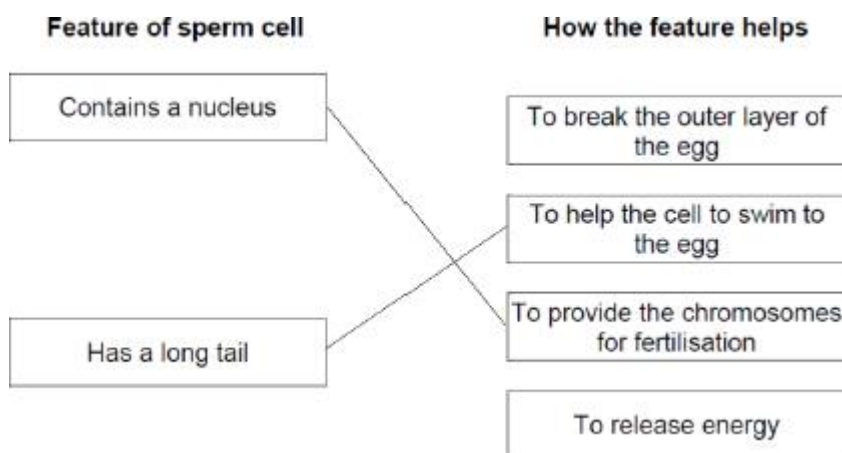
1

(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

[13]

**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<br><i>allow ileum</i><br><i>ignore intestine unqualified</i><br><i>do <b>not</b> accept large intestine / duodenum</i> | 1           |
| (i) | active transport   | 1           |
|     | osmosis  | 1           |
|     |  | <b>[10]</b> |

**Q5.**

- |     |  |   |
|-----|--|---|
| (a) | the movement of particles from a high concentration to a low concentration   | 1 |
| (b) | (gills) have (many) projections<br><i>allow description of projections</i><br><i>allow have lots of / five gills</i> | 1 |
|     | (for) large(r) surface / area  |   |
|     | <b>or</b>  |   |
|     | (gills) are on the outside of the body (1)   |   |
|     | for good access to water (1)   | 1 |
| (c) | differentiation  | 1 |
| (d) | mitosis<br><i>do <b>not</b> accept meiosis</i>   | 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 1
- ignore sexual reproduction*
- (h) asexual (reproduction) 1
- allow cloning*
- [10]**

**Q8.**

- (a) (yes, because) the mass change (of egg 4) is much lower than the others 1
- 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)*

- (b)  $\frac{75.7 - 72.4}{72.4} \times 100$  1
- or equivalent*

- 4.6 (%) 1
- allow 4.558 / 4.56 (%)  
allow any correct rounding of  
4.558011049723757*
- an answer of 4.6 / 4.56 / 4.558 scores 2  
marks*

- (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 (cm<sup>2</sup>)

1

- (b) (volume =) 8 (cm<sup>3</sup>)

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 cm<sup>3</sup>

*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 O<sub>2</sub>*
- carbon dioxide  
*allow CO<sub>2</sub>*  
*in this order only*  
*both needed for 1 mark*  
1
- (c) less diffusion

- allow less gas will enter / leave the blood*  
*allow ecf from (b)*
- 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:
- men would be included in the study (can't be pregnant)
  - children / older (post-menopausal) women would be included in the study
- ignore reference to cost*
- 1
- (f) any **three** from:
- 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
- allow converse throughout*  
*allow appropriate use of correct figures throughout*
- 3
- (g) scatter graph
- 1
- (h) **B**
- 1
- (i) there is no correlation (between the variables)
- allow (all) the points are widely scattered*  
*allow idea that the person with the longest birth time does not have the highest risk*
- 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 <b>two</b> from:	
	• concentration of solutions	
	• drying of chips	
	• accuracy of balance	
	• evaporation from tubes	2
		<b>[13]</b>

**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 CO<sub>2</sub> 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

**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]**