

2

(a) In humans there are two types of cell division: **mitosis** and **meiosis**.

The table below gives statements about cell division.

Tick (✓) **one** box in each row to show if the statement is true for mitosis only, for meiosis only, or for both mitosis **and** meiosis.

The first row has been done for you.

Statement	Mitosis only	Meiosis only	Both mitosis and meiosis
How cells are replaced	✓		
How gametes are made			
How a fertilised egg undergoes cell division			
How copies of the genetic information are made			
How genetically identical cells are produced			

(4)

(b) Stem cells can be taken from human embryos.

In therapeutic cloning, an embryo is produced that has the same genes as the patient.

(i) Name **one** source of human stem cells, other than human embryos.

(1)

(ii) Stem cells from embryos can be transplanted into patients for medical treatment.

Give **one** advantage of using stem cells from embryos, compared with cells from the source you named in part (i).

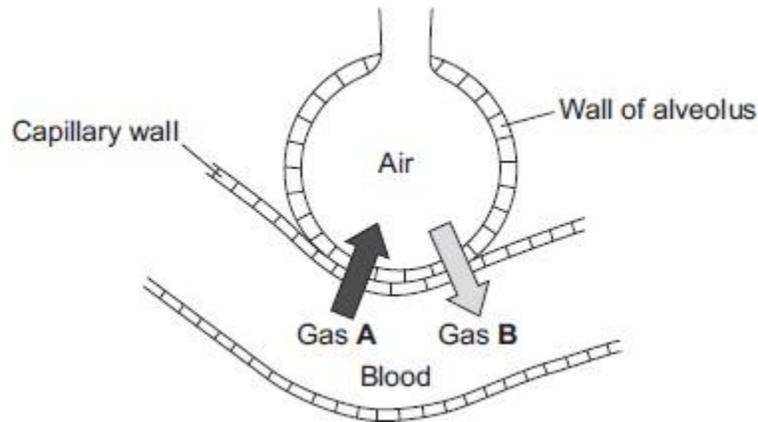
(1)

(Total 6 marks)

3 Gas exchange takes place in the lungs.

The diagram shows an alveolus next to a blood capillary in a lung.

The arrows show the movement of two gases, **A** and **B**.



(a) (i) Draw a ring around the correct answer to complete the sentence.

Gases **A** and **B** move by

- diffusion.
- osmosis.
- respiration.

(1)

(ii) Gas **A** moves from the blood to the air in the lungs.

Gas **A** is then breathed out.

Name Gas **A**.

(1)

(iii) Which cells in the blood carry Gas **B**?

Draw a ring around the correct answer.

platelets

red blood cells

white blood cells

(1)

(b) The average number of alveoli in each human lung is 280 million.

The average surface area of 1 million alveoli is 0.25 m^2 .

Calculate the total surface area of a human lung.

Answer _____ m^2

(2)

- (c) An athlete trains to run a marathon. The surface area of each of the athlete's lungs has increased to 80 m^2 .

Give **one** way in which this increase will help the athlete.

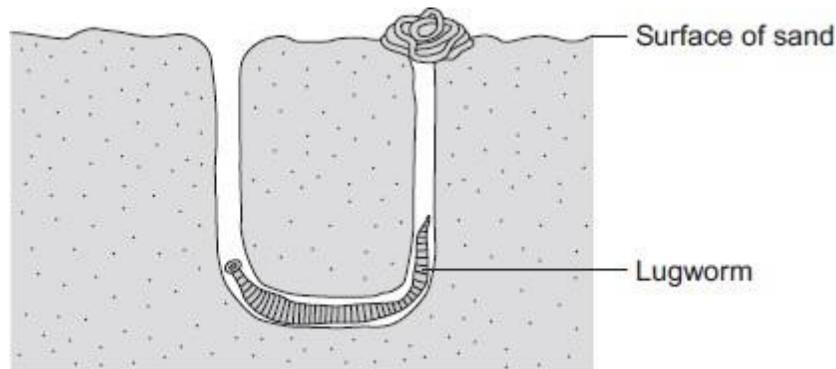
(1)

(Total 6 marks)

4

The lugworm lives in a U-shaped burrow in the sand on the seashore.

The diagram below shows a lugworm in its burrow.



- (a) Some scientists investigated the effect of different salt concentrations on lugworms.

The scientists:

- collected 50 lugworms from the seashore
- separated them into five groups of 10 lugworms
- weighed each group of 10 lugworms
- placed each group into a different concentration of salt solution and left them for 8 hours
- took each lugworm out of the solution and placed it on blotting paper for 30 seconds
- re-weighed each group of 10 lugworms.

- (i) Why did the scientists use groups of 10 lugworms and not just 1 lugworm at each concentration?

(1)

- (ii) Suggest why the scientists placed each lugworm on blotting paper for 30 seconds before they reweighed the groups of lugworms.

(1)

- (iii) How might the method of blotting have caused errors in the results?

(1)

- (iv) Suggest **one** improvement the scientists could make to their investigation.

(1)

- (b) The table below shows the scientists' results.

Concentration of salt in arbitrary units	Mass of 10 lugworms at start in grams	Mass of 10 lugworms after 8 hours in grams	Change in mass in grams	Percentage (%) change in mass
1.0	41.2	61.8	+20.6	+50
2.0	37.5	45.0	+7.5	
3.0	55.0	56.1	+1.1	+2
4.0	46.2	22.2	-24.0	-52
5.0	45.3	22.6	-22.7	-50

- (i) The scientists calculated the **percentage** change in mass at each salt concentration.

Why is the **percentage** change in mass more useful than just the change in mass in grams?

Use information from the table in your answer.

(2)

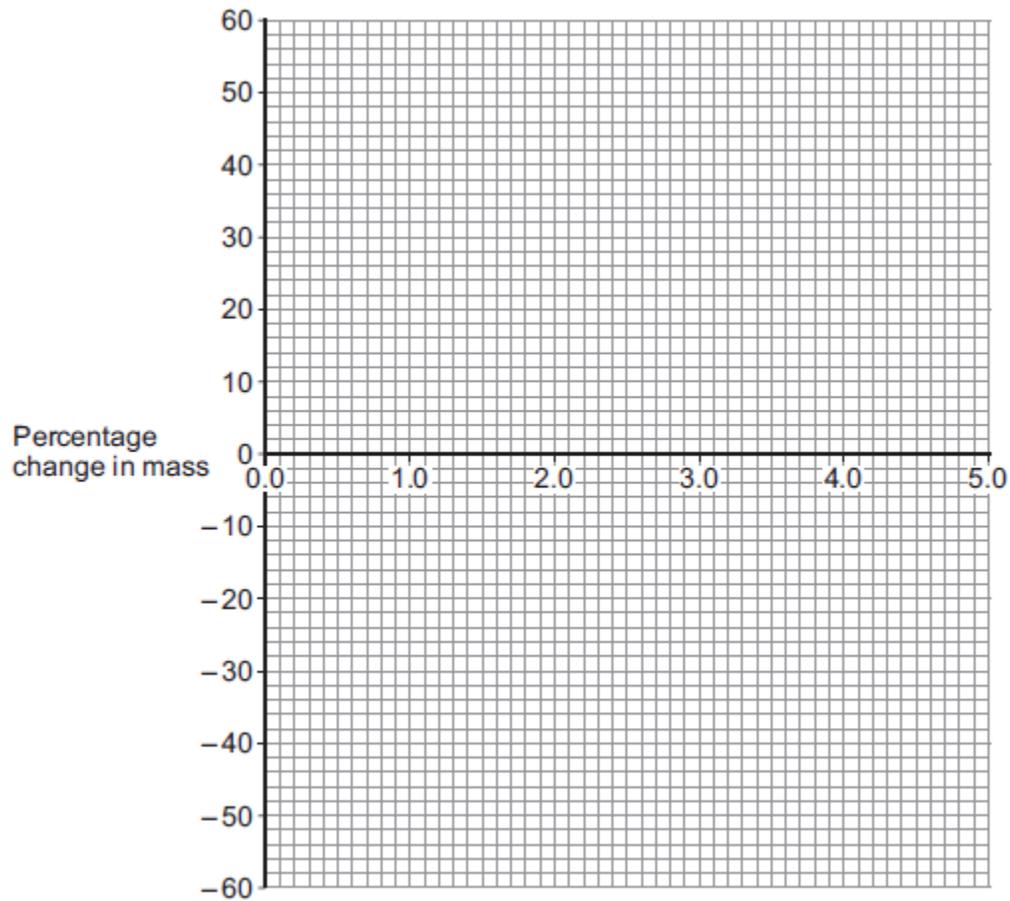
- (ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

Percentage change in mass = _____ %

(2)

- (c) (i) On the graph paper below, draw a graph to show the scientists' results:

- plot the **percentage** change in mass
- label the horizontal axis
- draw a line of best fit.



(4)

- (ii) The scientists thought one of their results was anomalous.
Draw a ring around the anomalous result on your graph.

(1)

(iii) Suggest what might have happened to cause this anomalous result.

(1)

(d) (i) What do you think is the concentration of salts in the lugworm's natural environment?

Use information from your graph to give the reason for your answer.

Concentration = _____%

Reason _____

(2)

(ii) The mass of the lugworms decreased in the salt solution with a concentration of 5.0 arbitrary units.

Explain what caused this.

(3)

(Total 19 marks)

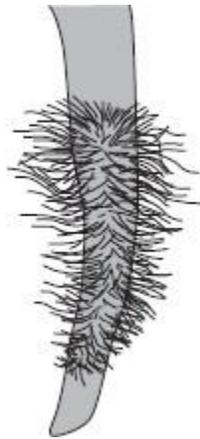
5

Plant roots absorb water from the soil by osmosis.

(a) What is osmosis?

(3)

(b) The image below shows part of a plant root.



The plant root is adapted for absorbing water from the soil.

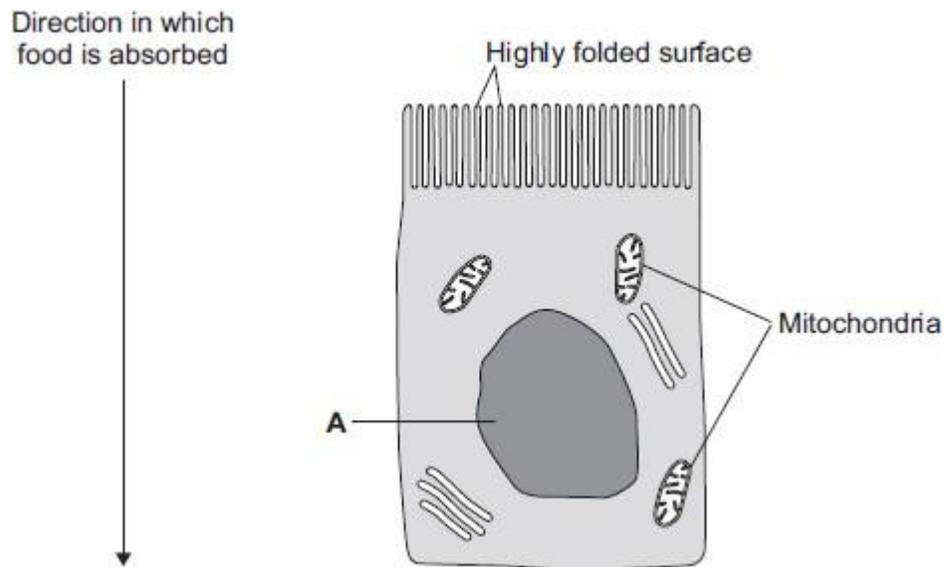
Use information from the diagram to explain how this plant root is adapted for absorbing water.

(3)

(Total 6 marks)

6

The image below shows an epithelial cell from the lining of the small intestine.



- (a) (i) In the image above, the part of the cell labelled **A** contains chromosomes.

What is the name of part **A**?

(1)

- (ii) How are most soluble food molecules absorbed into the epithelial cells of the small intestine?

Draw a ring around the correct answer.

diffusion

osmosis

respiration

(1)

- (b) Suggest how the highly folded cell surface helps the epithelial cell to absorb soluble food.

(1)

- (c) Epithelial cells also carry out active transport.

- (i) Name **one** food molecule absorbed into epithelial cells by active transport.

(1)

(ii) Why is it necessary to absorb some food molecules by active transport?

(1)

(ii) Suggest why epithelial cells have many mitochondria.

(2)

(d) Some plants also carry out active transport.

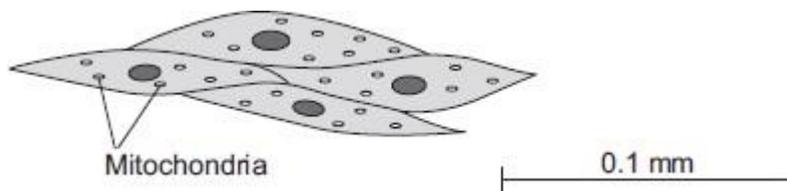
Give **one** substance that plants absorb by active transport.

(1)

(Total 8 marks)

7

The image below shows some muscle cells from the wall of the stomach, as seen through a light microscope.



(a) Describe the function of muscle cells in the wall of the stomach.

(2)

(b) The figure above is highly magnified.

The scale bar in the figure above represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of the figure above.

Magnification = _____ times

(2)

(c) The muscle cells in **Figure above** contain many mitochondria.

What is the function of mitochondria?

(2)

(d) The muscle cells also contain many ribosomes. The ribosomes cannot be seen in the figure above.

(i) What is the function of a ribosome?

(1)

(ii) Suggest why the ribosomes **cannot** be seen through a light microscope.

(1)

(Total 8 marks)

Mark schemes

- 1** 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*

[6]

2

(a)

	Mitosis only	Meiosis only	Both mitosis and meiosis
How cells are replaced	✓		
How gametes are made		✓	
How a fertilised egg undergoes cell division	✓		
How copies of the genetic information are made			✓
How genetically identical cells are produced	✓		

*if more than one tick per row then no mark
ignore first row*

1
1
1
1

(b) (i) (adult) bone marrow

accept (umbilical) cord blood, skin, amniotic fluid / membrane

1

(ii) cells will not be rejected by the patient's body (if they have been produced by therapeutic cloning)

allow easier to obtain linked to embryo stem cells

or

(embryo stem cells) can develop into many different types of cells

allow doesn't need an operation linked to bone marrow

or

(embryo stem cells) not yet differentiated / specialised or undifferentiated

accept embryo cells are pluripotent

1

[6]

3

(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]

4

(a) (i) variation in masses / more representative / more typical / more reliable / average /
mean / reference to anomalies
or
one worm to light to measure change
do not allow more accurate / more precise
ignore fair test / valid / repeatable / reproducible 1

(ii) remove solution / liquid (on outside of worm)
allow 'water' 1

(iii) variable amounts removed from each worm
ignore reference to length of timing 1

(iv) equal sizes of worm / more worms (in each group) / wash off all the sand /
repeats / use more accurate balance / use smaller concentration intervals
allow reference to improve blotting technique eg blot before / blot
more thoroughly 1

(b) (i) different (starting) masses / sizes / weights (at different concentrations) 1

allows comparisons / shows pattern / shows trend 1

(ii) (+)20

correct answer = 2 marks, with or without working

or

$$\frac{7.5 \times 100}{37.5} \quad / \quad \frac{7.5}{37.5} \quad / \quad \frac{(45.0 - 1) \times 100}{37.5}$$

for 1 mark

2

(c) (i) graph:

points correct

allow ± 1 mm

-1 mark per error

allow ecf from part b(ii)

2

label on x-axis including units – ie Concentration of salt in arbitrary units

1

line of best fit = smooth curve / ruled straight line

anomaly (4.0, -52) either plotted and ignored re. line

or not plotted

do not allow point to point

allow best fit for ecf from 2bii

1

(ii) on graph:

ring drawn around point at (4.0, -52)

allow (5.0, -50) if cand. line indicates this

1

(iii) sensible suggestion – eg used wrong solution / used 5.0% instead of 4.0% /
different length of time in solutions / ref to error in blotting / balance not zeroed /
error in weighing

allow some lugworms died

allow error in calculation

1

(d) (i) 2.9 to 3.0 / correct for candidate's graph ± 0.1

1

value of no change in mass / worms in equilibrium with soln / described

allow small(est) mass change

1

(ii) water loss

1

by osmosis / diffusion

1

from dilute region in the worm to more concentrated solution outside
*allow correct description in terms of high to low water concentration
/ high to low water potential
salt solution is hypertonic
concentration unqualified = salt concentration*

1

[19]

5 (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]

6 (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]

- 7** (a) contract / shorten
ignore relax
do not allow expand 1
- to churn / move / mix food
accept peristalsis / mechanical digestion
ignore movement unqualified 1
- (b) 400
acceptable range 390-410
allow 1 mark for answer in range of 39 to 41
allow 1 mark for answer in range of 3900 to 4100 2
- (c) to transfer energy for use
allow to release / give / supply / provide energy
do not allow to 'make' / 'produce' / 'create' energy
allow to make ATP
ignore to store energy 1
- by (aerobic) respiration **or** from glucose
do not allow anaerobic
energy released for respiration = max 1 mark 1
- (d) (i) to make protein / enzyme
ignore 'antibody' or other named protein 1

(ii) too small / very small

allow light microscope does not have sufficient magnification / resolution

allow ribosomes are smaller than mitochondria

ignore not sensitive enough

ignore ribosomes are transparent

1

[8]