Cell Biology part 1 AQA Triple Biology

Name: _____

Class: _____

Date: _____

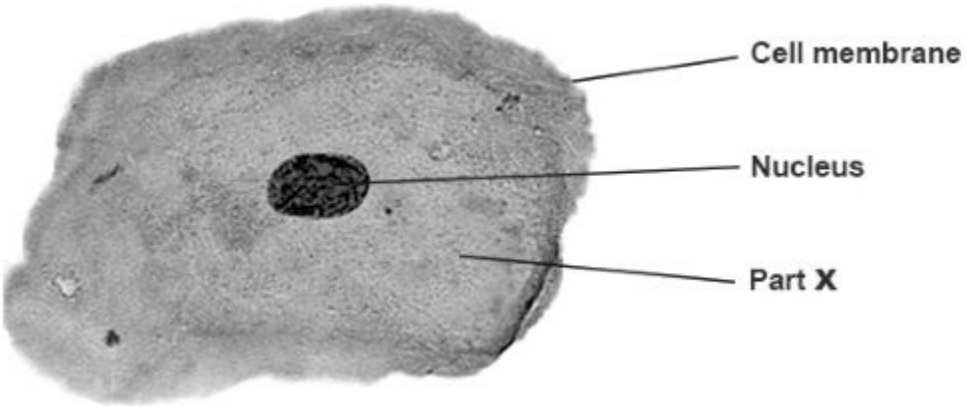
Time: **75 minutes**

Marks: **70 marks**

Comments:

1. This question is about cells.

(a) The figure below shows an animal cell seen through a microscope.



What is part **X** in the figure above?

Tick (✓) **one** box.

Cytoplasm ☐

Mitochondrion ☐

Vacuole ☐

(1)

(b) Name **one** structure found in the nucleus.

_____

(1)

(c) Name **one** cell part that is found in a plant cell but is **not** found in an animal cell.

_____

(1)

(d) Root hair cells are found in plants.

Which substance do root hair cells absorb from the soil?

Tick (✓) **one** box.

Glucose	☐
Protein	☐
Water	☐

(1)

(e) A sperm cell is a specialised cell.

What is the function of a sperm cell?

_____

_____

(1)

(f) Draw **one** line from each specialised cell to the type of organism where the specialised cell is found.

Specialised cell	**Type of organism**
Nerve cell	Animals
	Bacteria
Xylem cell	Fungi
	Plants

(2)

(g) The cell membrane controls which substances move into and out of cells.

Which **two** processes move substances into and out of cells?

Tick (✓) **two** boxes.

Active transport ☐

Diffusion ☐

Mitosis ☐

Mutation ☐

Respiration ☐

(2)

(h) The table below shows substances that are exchanged between the blood and muscle cells.

Complete the table below to show the direction of movement of each substance.

Tick (✓) **one** box in each row.

Substance	**Direction of movement of substance**		
	ONLY from blood to muscle cells	**ONLY from muscle cells to blood**	**From blood to muscle cells AND from muscle cells to blood**
Carbon dioxide			
Oxygen			
Water			

(3)

(Total 12 marks)

2. Blood contains different types of cell.

(a) Complete the sentences.

Choose answers from the box.

antibiotics	**antitoxins**	**painkillers**	**pathogens**

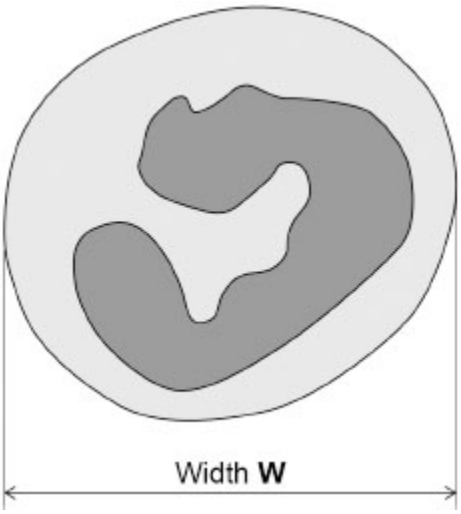
White blood cells defend the body against _____.

Some white blood cells release chemicals that neutralise toxins. These chemicals are called _____.

(2)

(b) **Figure 1** shows a white blood cell.

Figure 1



The image of the white blood cell in **Figure 1** is magnified 4000 times.

Calculate the real width of the white blood cell.

Complete the following steps.

Measure width **W** in millimetres (mm).

Width **W** = _____ mm

Convert your measurement to micrometres (µm).

1 millimetre (mm) = 1000 micrometres (µm).

_____

_____

Width **W** in micrometres = _____ µm

Calculate the real width of the white blood cell.

Use the equation:

$$\text{real width} = \frac{\text{width W (µm)}}{\text{magnification}}$$

_____

_____

_____

Real width = _____ µm

(4)

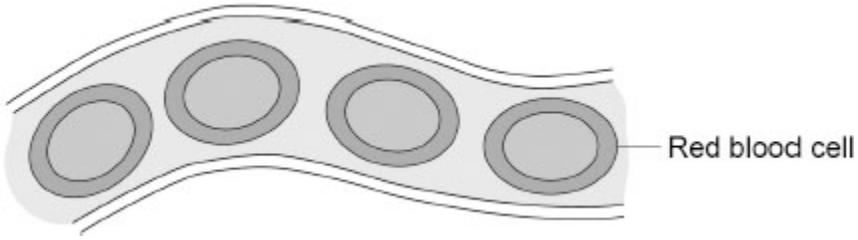
The table below shows information about different types of blood vessel.

Blood vessel	**Width of blood vessel in micrometres (µm)**	**Pressure of blood travelling through the blood vessel**
Artery	10 000	High
Capillary	10	Low
Vein	20 000	Very low

(c) The width of a red blood cell is 8 µm.

Figure 2 shows red blood cells in one type of blood vessel.

Figure 2



Which type of blood vessel is shown in **Figure 2**?

Use the table above.

Tick (✓) **one** box.

Artery ☐

Capillary ☐

Vein ☐

(1)

(d) Explain why arteries need to have thick walls.

Use the table above.

_____

_____

_____

_____

(2)

Coronary arteries in the heart can become narrowed.

(e) What happens inside coronary arteries to cause them to become narrowed?

_____

_____

(1)

(f) Explain why narrowed coronary arteries can be dangerous.

_____

_____

_____

_____

(2)

(g) Treatments are available for some cardiovascular diseases.

Draw **one** line from each cardiovascular disease to a treatment for the disease.

Cardiovascular disease	**Treatment**
A blocked coronary artery	Antibiotics
Heart failure	Heart transplant
High blood cholesterol	Statins
	Stent

(3)

(h) Why is coronary heart disease described as a 'non-communicable disease'?

_____

_____

(1)

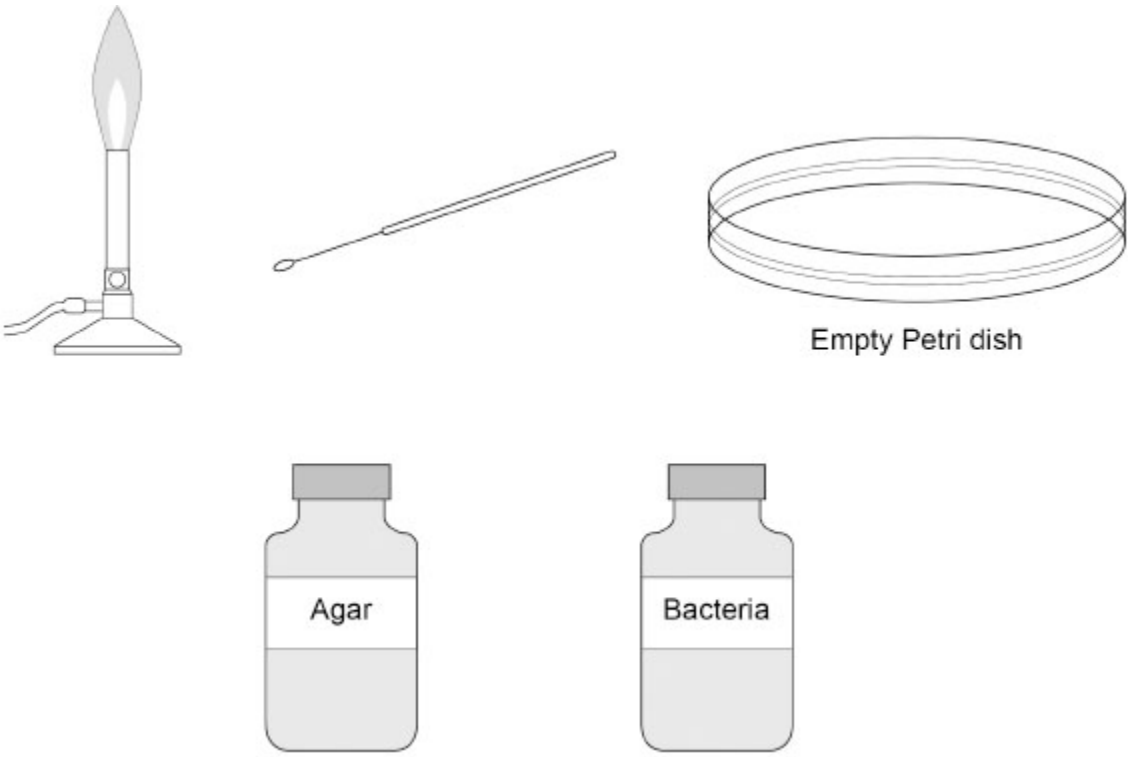
(Total 16 marks)

3. A student investigated the effect of antibiotics on the growth of bacteria.

The student prepared an agar gel plate.

Figure 1 shows some of the equipment the student used.

Figure 1



(a) Describe a method the student could use to:

- prepare a sterile agar gel plate
- grow an uncontaminated sample of bacteria on the agar gel plate.

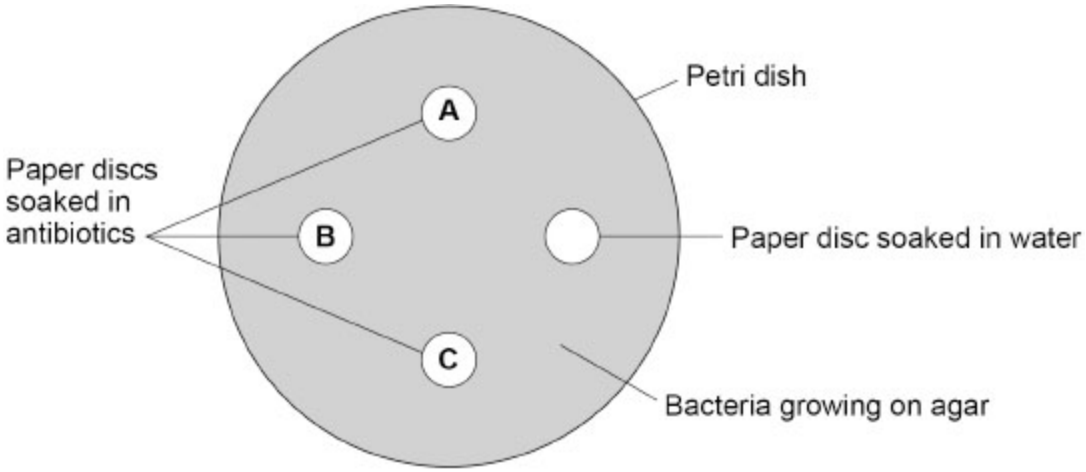
Use the equipment in **Figure 1** in your answer.

(6)

The student used an agar gel plate to test three antibiotics, **A**, **B** and **C**.

Figure 2 shows how the agar gel plate was set up.

Figure 2



(b) The student incubated the agar gel plate at 25 °C.

Why should the temperature **not** be higher than 25 °C?

_____

_____

(1)

(c) What was the purpose of the paper disc soaked in water?

Tick (✓) **one** box.

To check the bacteria were uncontaminated. ☐

To make the investigation more accurate. ☐

To show the effect of no antibiotics. ☐

(1)

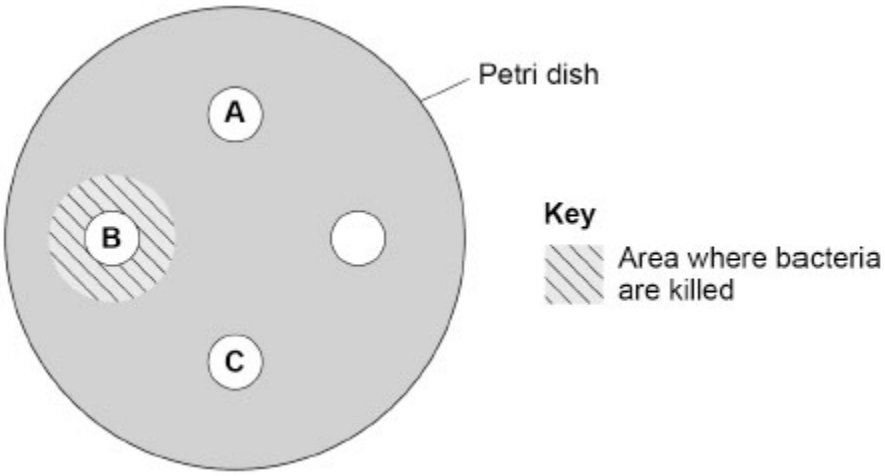
(d) The student removed the agar gel plate from the incubator after 48 hours.

Antibiotic **A** was the **most** effective at killing the bacteria.

Antibiotic **C** was the **least** effective at killing the bacteria.

Figure 3 shows the results for the disc soaked in antibiotic **B**.

Figure 3



Complete **Figure 3** to show the results you would expect.

You should:

- draw a ring around the disc soaked in antibiotic **A**
- draw a ring around the disc soaked in antibiotic **C**.

(2)

(e) The student repeated the investigation with antibiotic **D**.

The bacteria were resistant to antibiotic **D**.

What effect would antibiotic **D** have had on the bacteria?

Tick (✓) **one** box.

All of the bacteria would have been killed. ☐

Some of the bacteria would have been killed. ☐

None of the bacteria would have been killed. ☐

(1)

(Total 11 marks)

4. A student investigated osmosis in pieces of potato.

This is the method used.

1. Cut a piece of potato into a cube.
2. Record the mass of the cube.
3. Place the cube into a beaker containing 0.4 mol/dm^3 salt solution.
4. After some time, remove the cube and record the mass.
5. Calculate the change in the mass of the cube.
6. Repeat steps 1 to 5 using two more different concentrations of salt solution.

(a) Evaluate the student's method.

You should include how the student could improve the validity of their results.

(6)

(b) Why would a potato cube placed into distilled water increase in mass?

Tick (✓) **one** box.

The solution in the potato cells was less concentrated than the distilled water.	☐
The solution in the potato cells was more concentrated than the distilled water.	☐
The volume of water in the potato cells was greater than the volume of distilled water.	☐
The volume of water in the potato cells was less than the volume of distilled water.	☐

(1)

(c) Active transport is another process used by potato cells.

Give **one** way active transport is different from osmosis.

_____

_____

(1)

(Total 8 marks)

5. Plants contain many different tissues.

(a) Complete the sentences.

The leaf tissue that contains the most chloroplasts is

the _____ .

The leaf tissue that contains many air spaces is

the _____ .

The plant tissue that can differentiate throughout the life of the plant is

the _____ .

(3)

(b) Xylem tissue transports water through a plant.

The walls of xylem cells contain cellulose.

Name **one other** substance that strengthens xylem tissue.

_____

(1)

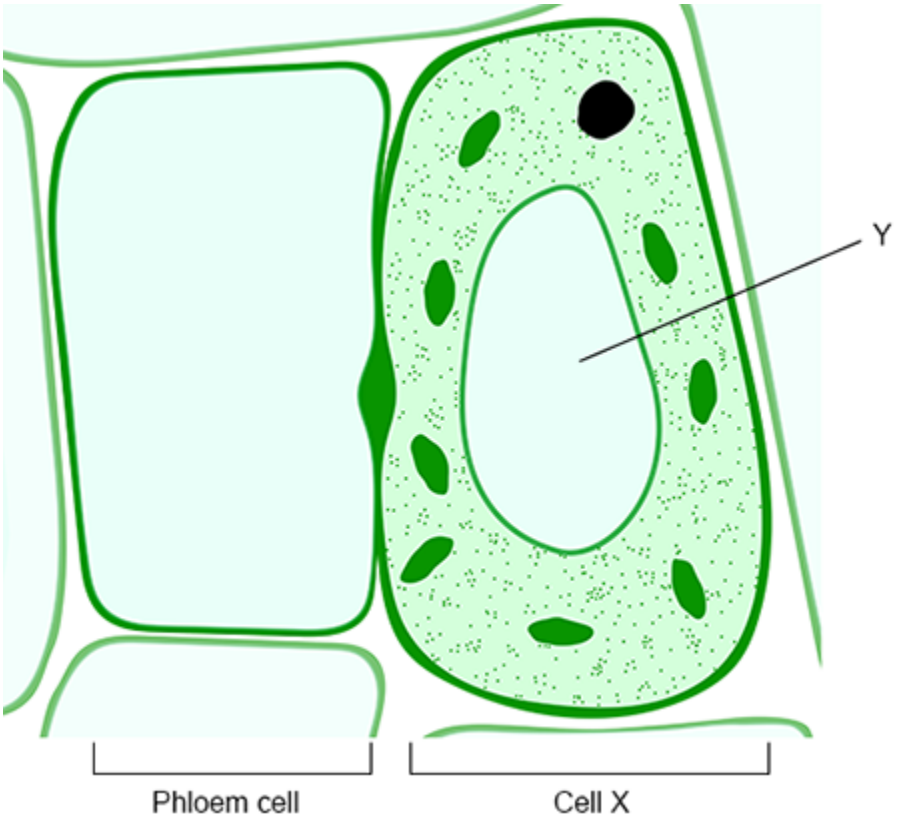
(c) Phloem tissue transports dissolved sugars around a plant.

Name the process that transports dissolved sugars around a plant.

_____

(1)

The figure below shows two plant cells.



(d) Name part **Y** in the figure above.

_____

(1)

(e) The phloem tissue transports sugars to other parts of the plant.

The concentration of dissolved sugars in the phloem cell in above figure is higher than in cell **X**.

Explain how sub-cellular structures help to move dissolved sugars from cell **X** into the phloem cell.

(5)

(f) New phloem cells form when unspecialised plant cells differentiate and become specialised.

Describe **one** change in structure that occurs when an unspecialised cell differentiates to form a phloem cell.

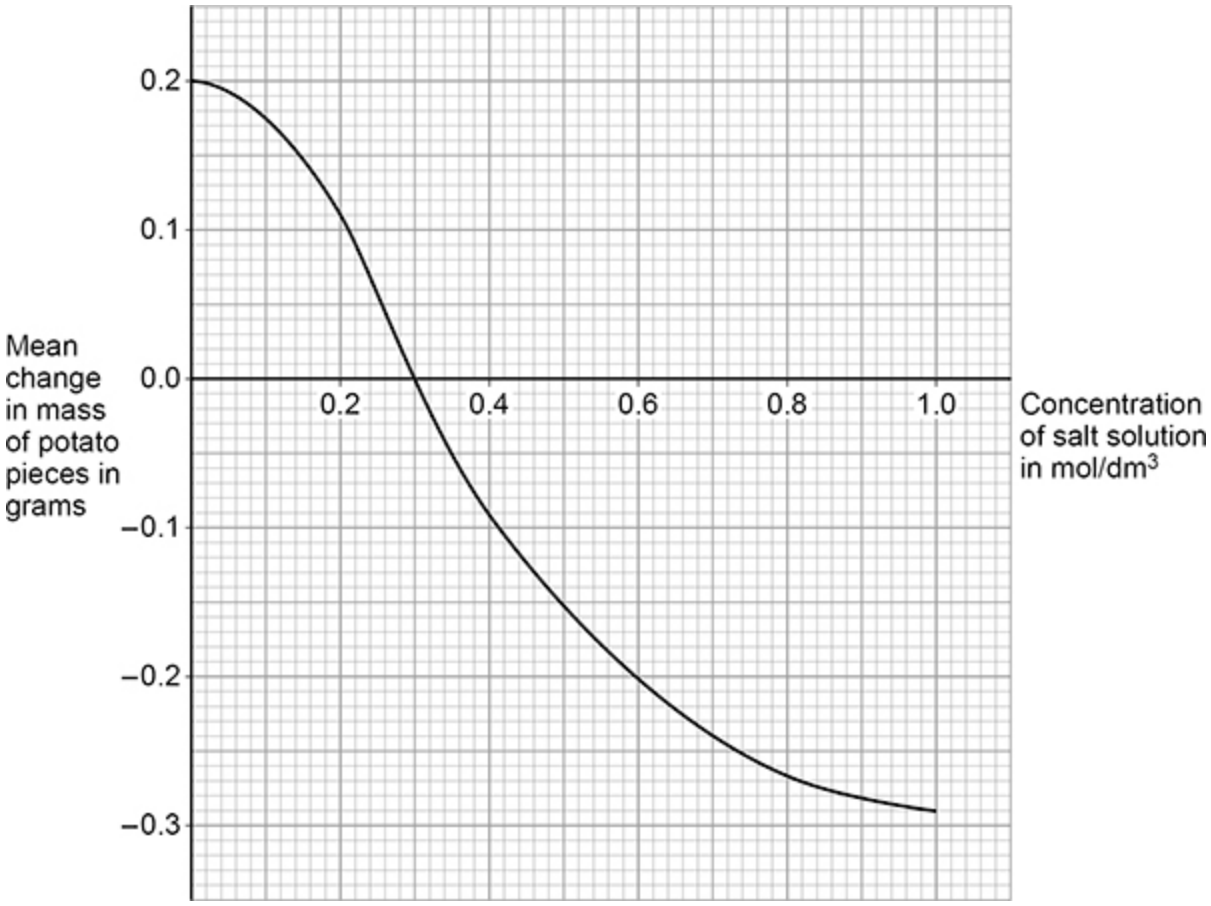
Use the above figure.

(1)

(Total 12 marks)

6. A student investigated the effect of concentration of salt solution on the mass of uncooked potato pieces.

The figure below shows the results.



(a) Plan a method that could be used to obtain the results in the figure above.

(6)

(b) Explain the result for the potato pieces in the 0.6 mol/dm^3 salt concentration.

(3)

(c) Explain why the result for the potato pieces at 1.0 mol/dm^3 was different from the result at 0.6 mol/dm^3.

_____

_____

_____

_____

(2)

(Total 11 marks)

1. (a) cytoplasm

1

(b) any **one** from:

- chromosome(s)
- gene(s)

allow DNA / allele

allow genetic material

ignore genetic information

1

(c) any **one** from:

- (cell) wall

ignore cellulose

- (permanent / large) vacuole
- chloroplast

ignore chlorophyll

1

(d) water

1

(e) any **one** from:

- fertilisation

allow to fuse / join with an egg

allow to penetrate the egg

- to swim to the egg

allow to reach the egg

ignore swim unqualified

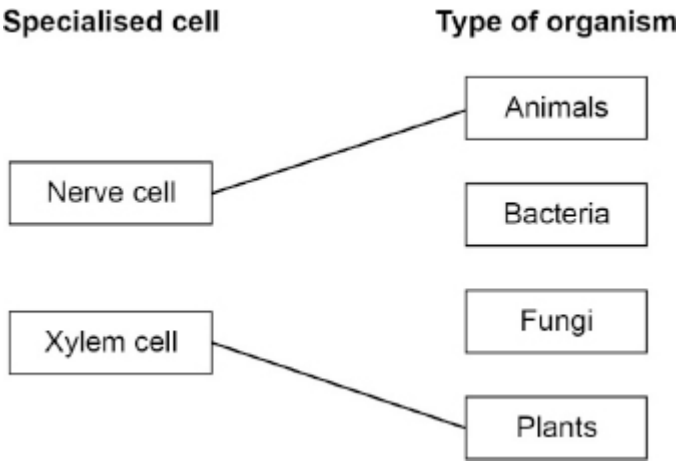
- to provide chromosomes / DNA for the egg

allow to provide genetic material / information for the egg

- to carry chromosomes / DNA from the male

1

(f)



do **not** accept more than one line from a box on the left

2

(g) active transport

1

diffusion

1

(h)

Substance	Direction of movement of substance		
	ONLY from blood to muscle cells	**ONLY from muscle cells to blood**	**From blood to muscle cells AND from muscle cells to blood**
Carbon dioxide		✓	
Oxygen	✓		
Water			✓

do **not** accept more than one tick in any row

3

[12]

2. (a) pathogens

1

antitoxins

in this order only

1

(b) *measurement*
60 (mm)

allow measurement in the range 59 (mm) to 61 (mm)

1

conversion
60 000 (µm)

allow correct conversion from incorrect measurement

1

substitution
$= \frac{60\,000}{4\,000}$

allow correct substitution using incorrect conversion

1

real width
15 (µm)

allow correct calculation using incorrectly converted value

1

(c) capillary

1

(d) (blood in arteries) has high pressure

1

(so need thick walls) to withstand / maintain the pressure
or
(so need thick walls) to prevent bursting

ignore to increase the pressure

*allow **2** marks for to withstand / maintain high pressure*

1

(e) deposits / build-up / increase of fat(ty material)

allow deposits / build-up / increase of cholesterol

allow deposits / build-up / increase of plaque

1

(f) less / no blood flow

1

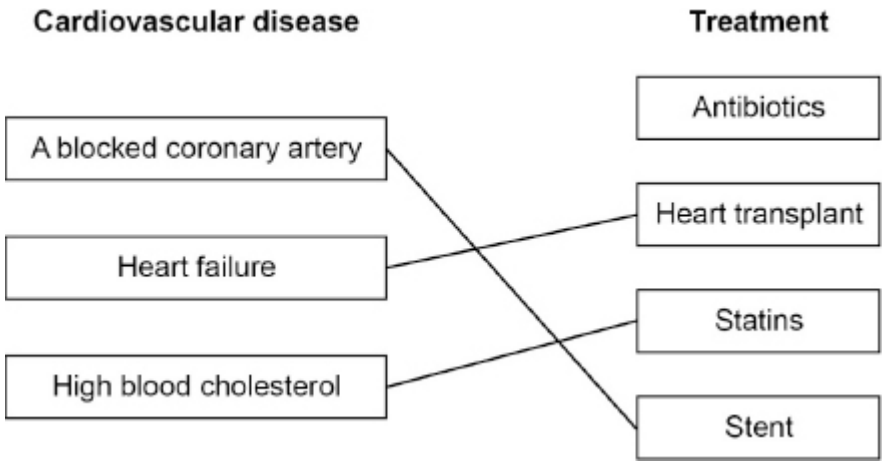
(so) less / no oxygen / glucose transported (to heart / body)

*allow **2** marks for less oxygenated blood flows*

*if no other marks awarded allow **1** mark for idea that it will lead to a heart attack*

1

(g)



do **not** accept more than one line from a box on the left

3

(h) because it cannot be spread / passed on (from one person to another)
or
because it is not caused by a pathogen / bacterium / virus / fungus / protist / microorganism / microbe

allow not contagious / infectious

ignore because it is a lifestyle disease

1

[16]

3. (a) **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

5-6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3-4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1-2

No relevant content.

0

Indicative content

preparation of agar plate

- melt agar
- pour agar into Petri dish
- allow agar to cool / set

transfer of bacteria

- transfer bacteria to agar / Petri dish **or** spread bacteria on agar / Petri dish
- transfer bacteria using (inoculating) loop **or** by pouring (liquid) bacterial culture

techniques to ensure sterile conditions (aseptic technique)

- wipe table with a disinfectant / antibacterial solution
  or
  sanitise hands using sanitiser gel
- sterilise agar by heating **or** using autoclave / UV **or** pressure cooker
- sterilise Petri dish by heating **or** using autoclave / UV **or** pressure cooker **or** ethanol
- sterilise neck of agar / bacteria bottle by passing through a flame
- only open lid of agar bottle minimally **or** only lift lid of Petri dish minimally
- work next to a Bunsen flame
- sterilise inoculating loop before use by dipping in alcohol / ethanol
- sterilise inoculating loop before use by passing through a flame

growth of bacteria

- incubate Petri dish upside down
- tape lid (correctly)
- incubate at 25 °C **or** leave bacteria to grow

For **Level 3**, a valid method must include preparation of the agar plate and transfer of the bacteria using sterile techniques.

For **Level 2**, a method must include preparation of the agar plate and transfer of the bacteria.

(b) to prevent growth of pathogens

allow to prevent growth of harmful bacteria / fungi / microorganisms

1

(c) to show the effect of no antibiotics

1

(d) larger ring drawn around antibiotic **A** than **B**

ignore ring drawn around blank / water disc

ignore shading / hatching within rings

1

smaller ring drawn around antibiotic **C** than **B**

*ignore no ring drawn around antibiotic **C***

1

(e) none of the bacteria would have been killed

1

[11]

4. (a) **Level 3**: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.

5-6

Level 2: Some logically linked reasons are given. There may also be a simple judgement.

3-4

Level 1: Relevant points are made. They are not logically linked. 1–2

1-2

No relevant content.

0

Indicative content:

(strengths)

- same / a / one plant / potato used
- all potato pieces used were cubes
- mass was recorded before and after
- change in mass was calculated
- different concentrations of salt solution were used

(improvement and reason)

- use the same / a / one potato for all pieces
  - (because the student) may have used different potatoes
- remove skin **or** peel the potato
  - (because) skin (may still be) present
- blot / dry cube before measuring mass
  - (because) cube will have excess water on surface
- use same / set size / surface area of potato piece each time
  - (because) size / surface area of cubes not controlled / specified
- repeat (whole investigation **or** at each concentration)
  - (because there were) no repeats
  - to spot anomalies
- calculate mean (from repeats)
  - (because there was) no mean calculated
- same time for each piece to be in solution
  - (because) length of time in solution not specified
- control temperature of solution using water bath
  - (because) temperature (of solution) not controlled / specified
- use same volume of solution for each piece of potato
  or ensure all pieces are completely submerged
  - (because) volume of solution not specified / controlled
- calculate percentage change in mass
  - (because) percentage change in mass not calculated
    or
    (because) each potato piece had a different starting mass
- include control experiment with boiled cube
  - (because) no control experiment included
- increase the number of concentrations (of salt solution) used
  - (because) only 3 different concentrations (of salt solution) used

For **Level 3**, a strength and improvements / reasons must be included.

(b) the solution in the potato cells was more concentrated than the distilled water

1

(c) any **one** from:

- requires energy

  ignore it is active

  allow it is not passive

- (transports substances) against / up a concentration gradient

  allow (transports substances) from low concentration to high concentration

  ignore (transports substances) along / across the concentration gradient

  *do **not** accept (transports substances) down a concentration gradient*

- transports minerals / ions (and not water)

  allow transports other named substances such as glucose

  allow does not transport water

1

[8]

5. (a) palisade (mesophyll / layer / cells)

1

spongy mesophyll / layer

1

meristem

must be in this order

*do **not** accept reference to a single cell, once only*

1

(b) lignin

ignore cellulose

1

(c) translocation

ignore active transport

1

(d) (permanent) vacuole

1

(e) (cell **X** contains) mitochondria

1

for (aerobic) respiration

*do **not** accept anaerobic respiration*

1

(mitochondria / respiration) releases energy

*do **not** accept energy produced / made / created*

1

<u>energy</u> needed to move (dissolved) **sugar(s)** against / up the concentration gradient

*allow <u>energy</u> needed to move (dissolved) **sugar(s)** from a low concentration to a high concentration*

1

by active transport

1

(f) any **one** from:

- loss of cytoplasm
- loss of nucleus
- loss of mitochondria
- loss of ribosomes
- loss of sub-cellular structures
- end walls become perforated

ignore description of a phloem cell

allow reference to sieve plate formation

allow cell walls form

allow (larger) vacuole forms

ignore reference to change in size / shape

1

[12]

6. (a) **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.

3–4

Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1–2

No relevant content

0

Indicative content:

- (measure and) record mass of potato pieces
- place potato pieces into different concentrations of salt solution
  - use at least 3 different concentrations of salt solution
- leave potato pieces in salt solutions
- remove potato pieces from salt solutions
- blot potato pieces dry
- (measure and record mass of potato pieces and) calculate change in mass
- repeat each concentration
  - repeat each concentration 2 **more** times
- calculate mean change in mass

Control variables

- use same size / mass potato pieces
- use same potato **or** use same type of potato
- use same blotting technique
- ensure no skin on potato pieces
- keep potato pieces in solution for the same amount of time (≥10 minutes)
- keep potato pieces in solutions at the same temperature

For **Level 1**, the method must allow the determination of the change in mass for a piece of potato.

For **Level 3**, the method must allow the production of the graph in the figure.

(b) (pieces) lost mass because <u>water</u> left cells / potato

1

(because) the solution in the cells / potato is less concentrated than outside
or
(because) the solution in the cells / potato is more dilute than outside

allow (because) the solution outside the cells / potato is more concentrated than inside

allow (because) the solution outside the cells / potato is less dilute than inside

allow correct references to <u>water concentration</u> / <u>potential</u>

ignore reference to amount of water or salt

*do **not** accept water moves from an area of high (solute) concentration to an area of low (solute) concentration*

1

water left cells / potato by osmosis

allow water left cells by diffusion through a partially / selectively / semi permeable membrane

1

(c) (pieces at 1.0 mol/dm^3) lost more mass because more water left potato / cells

(pieces at 1.0 mol/dm^3) lost more mass because more osmosis occurred out of the potato / cells

1

(because) there is a steeper concentration gradient (at 1.0 mol/dm^3)

allow there is a greater difference in the concentration between inside and outside the cells / potato at 1.0 mol/dm^3

1

[11]