

Cell Biology part 4 AQA Combined Science

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Class: _____

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Time: **79 minutes**

Marks: **63 marks**

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Q1.

This question is about plant transport systems.

- (a) Which **organ** in a plant absorbs water from the soil?

(1)

- (b) The concentration of nitrate ions in the soil is lower than the concentration of nitrate ions inside a plant.

How would the nitrate ions move from the soil into the cells of this plant?

Tick (✓) **one** box.

By active transport

By diffusion

By osmosis

(1)

Dissolved sugars are transported in the phloem.

- (c) What is the name of the process that moves dissolved sugars through the phloem?

Tick (✓) **one** box.

Evaporation

Osmosis

Translocation

(1)

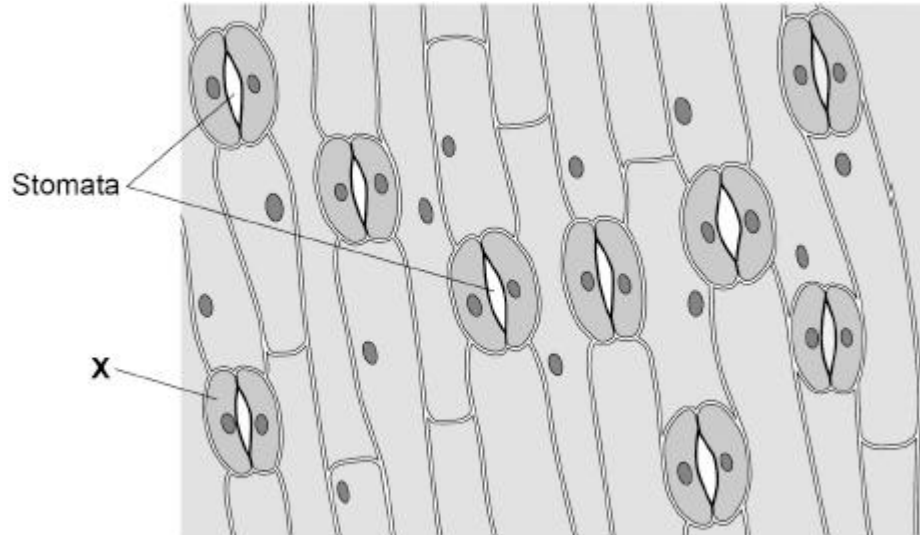
- (d) Give **one** use of sugars in a plant.

(1)

Stomata are openings on the surface of a leaf.

Stomata allow gases to move into and out of a leaf.

The figure below shows the surface of a leaf.



(e) What is cell **X**?

Tick (✓) **one** box.

Guard cell

Meristem cell

Palisade cell

(1)

(f) Why do the stomata open during the day?

Tick (✓) **one** box.

To allow carbon dioxide in

To allow nitrogen in

To allow oxygen in

(1)

(g) The area of the leaf shown in the figure above is 0.25 mm².

Calculate the number of stomata per mm² for the leaf in the figure above.

Use the equation:

$$\text{number of stomata per mm}^2 = \frac{\text{number of stomata}}{\text{area in mm}^2}$$

Number of stomata per mm² = _____

(2)

A student investigated the number of stomata per mm² on the upper and lower surfaces of leaves.

The leaves were taken from the same plant.

The table below shows the results.

Leaf	Number of stomata per mm ²	
	Upper surface	Lower surface
1	0	37
2	1	36
3	2	30
4	1	32
5	1	35
Mean	1	X

(h) Calculate mean value **X** in the table above.

X = _____

(2)

(i) Water vapour is lost through stomata.

Explain the difference in the number of stomata on the upper and lower surfaces of the leaves.

Use the table above.

(3)
(Total 13 marks)

Q2.

Pathogens are microorganisms that cause diseases.

Gonorrhoea, malaria and measles are three diseases in humans.

(a) Draw **one** line from each disease to the pathogen that causes the disease.

Disease	Pathogen
Gonorrhoea	Bacterium
Malaria	Fungus
Measles	Protist
	Virus

(3)

(b) Malaria is transmitted by mosquitos.

Male mosquitos can be sterilised so they are infertile.

The spread of malaria is reduced by releasing sterile mosquitos into the environment.

Explain how releasing sterile mosquitos reduces the spread of malaria.

(2)

Pathogens also cause diseases in plants.

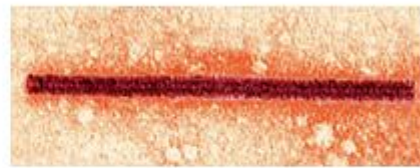
The figure below shows a rose black spot fungal spore and a tobacco mosaic virus.

Rose black spot fungal spore



← 16 μm →

Tobacco mosaic virus



← 2.5×10^{-7} m →

Images are **not** to the same scale

(c) Name the piece of equipment used to view the virus.

(1)

(d) How many times longer is the fungal spore than the virus?

Use the figure above.

Number of times longer = _____

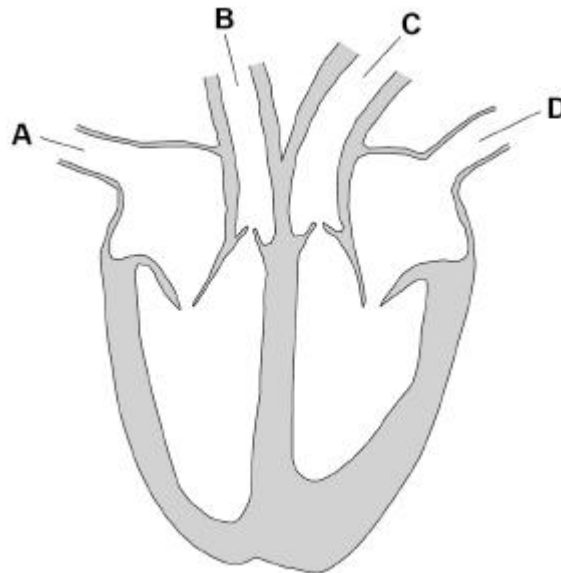
(3)

(e) Explain why plants infected with tobacco mosaic virus grow slowly.

(3)
(Total 12 marks)

Q3.

The figure below shows the human heart.



(a) Which blood vessel transports blood with the highest oxygen concentration **into** the heart?

Tick (✓) **one** box.

A

B

C

D

(1)

- (b) Blood pressure is a measure of the force of the blood against the walls of the blood vessels.

Which blood vessel transports blood at the highest pressure?

Tick (✓) **one** box.

A B C D

(1)

- (c) What is the correct order for blood flowing through the heart to the lungs?

Tick (✓) **one** box.

left atrium → left ventricle → pulmonary artery

left atrium → left ventricle → pulmonary vein

right atrium → right ventricle → pulmonary artery

right atrium → right ventricle → pulmonary vein

(1)

Scientists have developed patches of beating heart cells to repair damaged heart tissue.

The patches are placed onto areas of the heart where cells have died. New cells grow to replace the dead cells.

The patches are made using a person's own cells that are converted into stem cells.

(f) Explain why stem cells are used to make the patches.

(2)

(g) The scientists could have used human embryonic stem cells to make the patches.

Give **two** advantages of using stem cells made from the person's own cells, rather than using embryonic stem cells.

1 _____

2 _____

(2)

(Total 17 marks)

Q4.

This question is about plant transport systems.

(a) Describe how water is transported from the soil to the atmosphere through a plant.

(4)

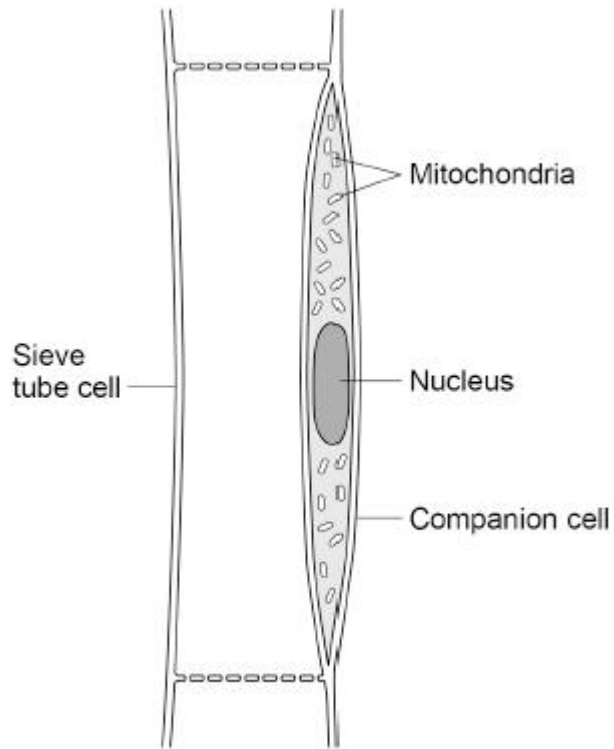
(b) Dissolved sugars are moved through a plant in phloem tissue.

What is the name of the process that moves dissolved sugars through phloem tissue?

(1)

Phloem tissue is made of sieve tube cells and companion cells.

The figure below shows a section of phloem tissue.



(c) Explain **one** way **sieve tube cells** are specialised for their function.

Use the figure above.

(2)

- (d) What does the structure of the companion cells suggest about the process that moves dissolved sugars through the phloem tissue?

Give a reason for your answer.

Use the figure above.

(2)

- (e) Describe why it is important that dissolved sugars are moved both upwards **and** downwards in a plant.

(3)

(Total 12 marks)

Q5.

A student investigated the effect of different concentrations of sugar solution on pieces of potato.

This is the method used.

1. Cut five pieces of potato.
2. Record the starting mass of each piece of potato.
3. Place each piece of potato in a different concentration of sugar solution.
4. After 24 hours remove the pieces of potato from the solutions.
5. Record the final mass of each piece of potato.
6. Calculate the change in mass for each piece of potato.

(a) What is the independent variable?

Tick (✓) **one** box.

Change in mass of the pieces of potato

Concentration of the sugar solution

Length of time the pieces of potato are in the solution

Starting mass of the pieces of potato

(1)

The table below shows the results.

Concentration of sugar solution in mol/dm ³	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	-0.40
0.4	7.93	7.18	-0.75
0.5	7.95	7.00	-0.95

(b) Explain why the potato in 0.0 mol/dm³ sugar solution increased in mass.

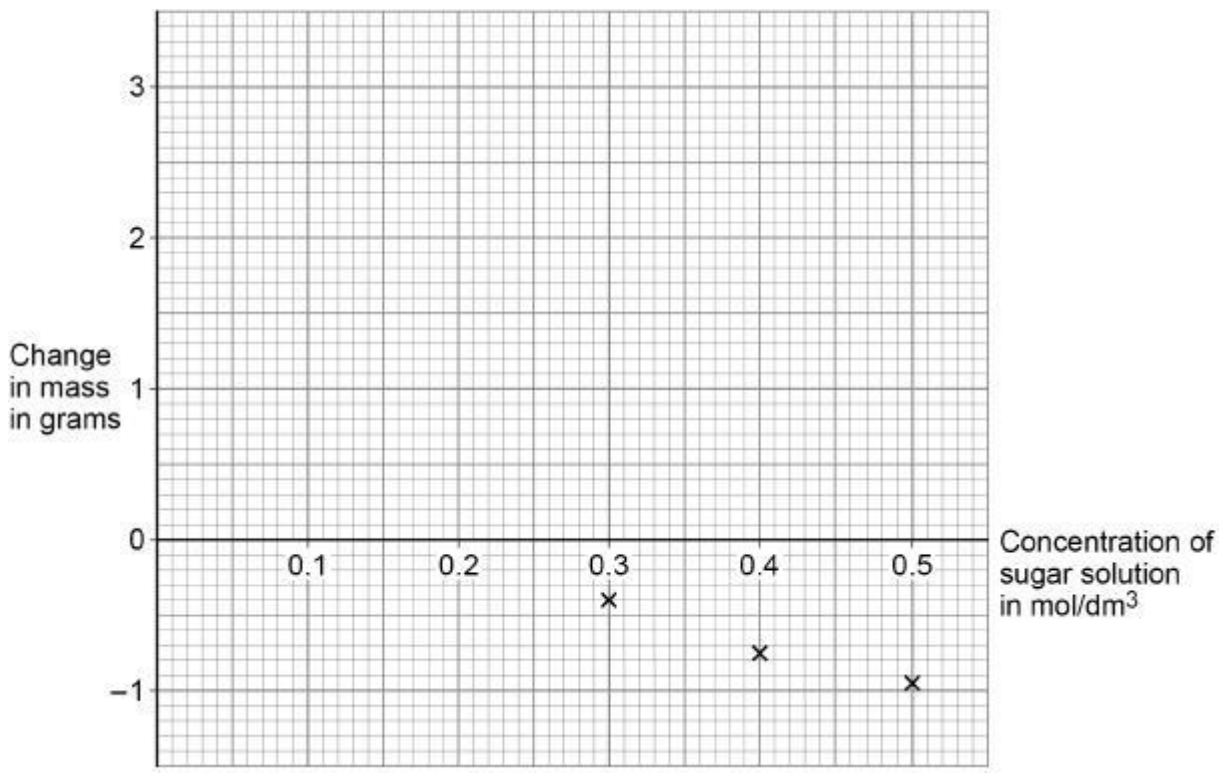
(2)

(c) Complete the graph below.

Some of the results have been plotted for you.

You should:

- plot the data from table above
- draw a line of best fit through all the points.



(2)

(d) The mass of a piece of potato does **not** change when:

concentration of solution inside cells = concentration of solution outside cells

Determine the concentration of sugar solution inside the potato cells.

Use the graph above.

Concentration = _____ mol/dm³

(1)

The table is repeated below.

Concentration of sugar solution in mol/dm ³	Mass of potato at start in grams	Mass of potato after 24 hours in grams	Change in mass in grams
0.0	7.94	10.14	2.20
0.1	7.95	9.10	1.15
0.2	7.96	8.21	0.25
0.3	7.93	7.53	-0.40
0.4	7.93	7.18	-0.75
0.5	7.95	7.00	-0.95

- (e) Calculate the percentage change in mass for the potato in 0.2 mol/dm³ sugar solution.

Use table above.

Use the equation:

$$\text{percentage change in mass} = \frac{\text{change in mass}}{\text{mass of potato at start}} \times 100$$

Give your answer to 3 significant figures.

Percentage change in mass (3 significant figures) = _____ %

(3)

(Total 9 marks)

Mark schemes

Q1.

- (a) root
do not accept root hair (cells) 1
- (b) by active transport 1
- (c) translocation 1
- (d) any **one** from:
 • respiration
allow to release energy
do not accept to produce / make / create energy
allow for growth
 • (used) to produce starch
 • (used) to produce fat / oil
 • (used) to produce cellulose
 • (used) to produce amino acids / protein 1
- (e) guard cell 1
- (f) to allow carbon dioxide in 1
- (g) $\frac{9}{0.25}$ 1
- 36
do not accept if a unit is given allow correct calculation using
 $\frac{9}{25}$ 1
- (h) $\frac{37 + 36 + 30 + 32 + 35}{5}$
allow $\frac{170}{5}$ 1
- 34 1
- (i) there are fewer stomata on the upper surface of the leaves
allow converse statements a comparative term is required 1

(conditions on upper surface will:) any **one** from:

- be warmer
- be drier
- be more exposed to wind
- have more light

1

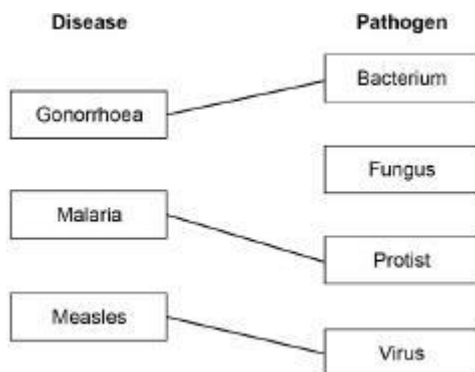
(so) less water will be lost

1

[13]

Q2.

(a)



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

1

1

1

(b) reduces breeding / reproduction (in mosquitos)

allow fewer (mosquito) eggs fertilised

allow no offspring produced (by sterile mosquitos)

1

(so) fewer mosquitos to bite people

or

(so) fewer mosquitos to pass on pathogen / protist

allow (so) less likely to be bitten by mosquitos

ignore fewer mosquitos to pass on malaria / disease

1

(c) electron microscope

ignore microscope unqualified

ignore scanning / transmission

*do **not** accept light microscope*

1

(d) (fungal spore)

(16 μm =) 1.6×10^{-5} m

or

(virus)

(2.5×10^{-7} m =) 0.25 μm

$$\frac{1.6 \times 10^{-5}}{2.5 \times 10^{-7}}$$

or

$$\frac{16}{0.25}$$

allow $\frac{0.000\ 016}{0.000\ 000\ 25}$

allow incorrect attempt at conversion or not converted value for length correctly substituted

1

(=) 64

allow a correctly calculated value using an incorrectly or not converted value for length

allow 1 mark **only** for $\frac{16}{2.5} = 6.4$

1

(e) discolouration in leaves

or

less chlorophyll in leaves

the idea of less is only needed once

ignore mosaic pattern of leaves unqualified

1

(so) reduced photosynthesis

allow less light absorbed

1

(so) less glucose produced so less amino acids / proteins / cellulose made

allow (so) less glucose so less energy for synthesis of chemicals

or

allow (so) less glucose for respiration (so) less energy transferred for growth

1

[12]

Q3.

(a) D

1

(b) C

1

(c) right atrium → right ventricle → pulmonary artery

1

(d) **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 AO1

1–2

No relevant content

0

Indicative content

Advantages of statins

- easy to take **or** not invasive (procedure)
- decrease blood cholesterol
- slow down build-up of fatty materials in arteries
- maintain blood flow to heart muscle cells
- low cost (compared to stent operation)

Disadvantages of statins

- might be side effects of drug eg muscle pain
- effects take time to happen
- drug will need to be taken long term
- might forget to take drug

Advantages of stent

- blocked artery is held open
- blood flow to heart muscle cells is increased
- stent will remain in place for a long time
- effect of stent is immediate
- rapid recovery from operation

Disadvantages of stent

- risk of infection from operation
- risk of surgery eg heart attack **or** bleeding
- risk of thrombosis **or** blood clot

For Level 3, arguments for and against **both** treatments are needed.

(e) heart (muscle) cannot contract / pump as effectively / powerfully

allow heart (muscle) is not as strong

1

(so) less blood pumped out of heart **or** to body (on each beat / contraction)

ignore reference to rate of blood flow

1

(so) less oxygen (reaches cells / body) for (aerobic) respiration

allow (so) more anaerobic respiration

1

(so) breathing rate increases to supply more oxygen

or

(so) breathing rate increases to repay oxygen debt

allow (so) breathing rate increases to break down lactic acid

1

- (f) stem cells are undifferentiated cells
allow stem cells can differentiate
allow stem cells can develop into different types of cell
ignore stem cells can become specialised
ignore stem cells are not specialised

1

(therefore) can form heart (muscle) cells
allow (therefore) can form muscle cells

1

- (g) any **two** from:
- cells will not be rejected
allow converse if clearly referring to embryonic stem cells
 - no risk of damage to embryo
allow no (potential) human life destroyed / damaged
 - adult can give consent
ignore unethical unqualified
ignore religion unqualified

2

[17]

Q4.

- (a) (absorbed from soil) by osmosis through root hair (cells)
allow (absorbed from soil) by diffusion through root hair (cells)

1

travels through xylem (vessels) to the leaves
ignore travels upwards in the xylem unqualified

1

lost through stomata (to atmosphere)

1

idea of driven by evaporation / transpiration
ignore evaporation / transpiration unqualified

1

- (b) translocation

1

- (c) have pores in the end walls
allow sap for dissolved sugars

1

(so) dissolved sugars / food / contents can move from cell to cell

or

no nucleus **or** few / no sub-cellular structures (1)

allow few / no organelles

ignore cells are empty

to maximise space for movement of dissolved sugars / food / contents (1)

*allow thick / rigid cell wall (1) to withstand
pressure inside cell*

1

(d) any **one** from: (the process):

- requires energy
- is an active process
- uses active transport

1

(reason) cells have many mitochondria

*allow flow of dissolved sugars / food in sieve tube
cell is not impeded (1)*

(reason) companion cell is flattened (1)

1

(e) sugars are made in the leaves by photosynthesis

allow glucose for sugar

*allow sugars are not made in the root / meristems
(by photosynthesis)*

1

all cells / tissues need sugar for respiration

*allow every cell / tissue needs sugar for
respiration*

*allow whole plant needs sugar as an energy
source*

1

(sugars) transported to meristems for growth / cell division / mitosis

or

(sugars) transported for storage as starch / fat / oil

1

[12]

Q5.

(a) concentration of the sugar solution

1

(b) gained water

1

(water moves) by osmosis

or

(because) concentration of water outside the potato is greater than inside the cells / potato

allow converse statements

(because) concentration (of sugar solution) inside the potato is greater than outside the potato / cells

1

(c) all points correctly plotted

allow $\pm \frac{1}{2}$ a square

1

line of best fit drawn as a curve through all the points

ignore extrapolation of curve

1

(d) correct reading from their graph

allow $\pm \frac{1}{2}$ a square

allow answer in range 0.23 to 0.24 (mol/dm³) if

no line drawn

1

(e)

$$\frac{0.25 \times 100}{7.96}$$

allow $\frac{(8.21-7.96) \times 100}{7.96}$

1

$$= 3.14(070352)$$

1

3.14 (%)

allow correct rounding to 3 sig figs of an incorrectly calculated percentage change

1

[9]