

Cell Biology part 6 AQA Combined Science

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Name: _____

Class: _____

Date: _____

Time: **69 minutes**

Marks: **68 marks**

Comments:

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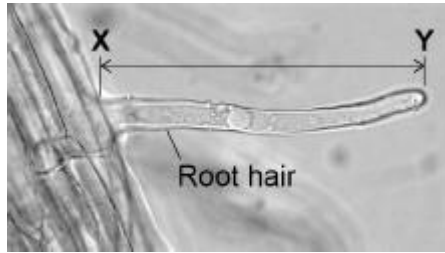
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Q1.

Figure 1 shows a root hair viewed using a microscope.

Figure 1



(a) The root hair was viewed at a magnification of $\times 50$

The image length of the root hair **X–Y** is 43 mm

Calculate the real length of the root hair in micrometres (μm).

Real length = _____ μm

(4)

(b) A microscope has a $\times 5$ eyepiece lens.

Describe how to use this microscope to observe a prepared slide of root hair cells at a magnification of $\times 50$

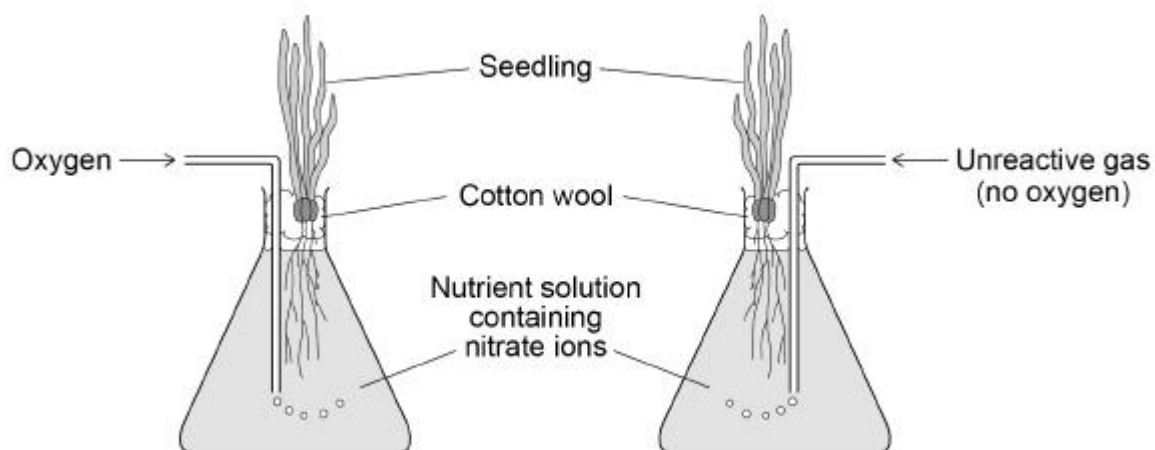
(4)

Root hair cells absorb water and mineral ions from the soil.

A scientist investigated the rate of nitrate ion uptake by two seedlings.

Figure 2 shows how the investigation was set up.

Figure 2



The scientist determined the mass of nitrate ions absorbed by each seedling every 30 minutes for 4 hours.

The table shows the results.

Time in hours	Total mass of nitrate ions absorbed by seedling in arbitrary units	
	With oxygen added	With no oxygen added
0	0	0
0.5	100	60
1.0	145	95
1.5	170	105
2.0	195	115
2.5	215	120
3.0	235	125
3.5	250	130
4.0	265	130

- (c) Describe the changes in the rate of absorption of nitrate ions for the seedling with **no** oxygen added.

Use information from the table.

(3)

- (d) Explain what the results in the table above show about how nitrate ions are absorbed.

(4)

- (e) Nitrate ions are essential for plants to grow.

Describe how nitrate ions are used in a plant to help the plant grow.

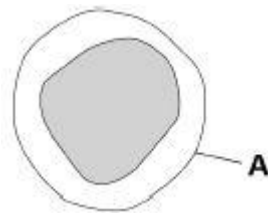
(3)

(Total 18 marks)

Q2.

Figure 1 shows one type of white blood cell.

Figure 1



(a) What is structure **A**?

Tick **one** box.

Cell membrane

Cell wall

Cytoplasm

Nucleus

(1)

(b) White blood cells help to defend the body against pathogens.

How do the white blood cells do this?

Tick **three** boxes.

Clone pathogens

Engulf pathogens

Produce antibiotics

Produce antibodies

Produce antitoxins

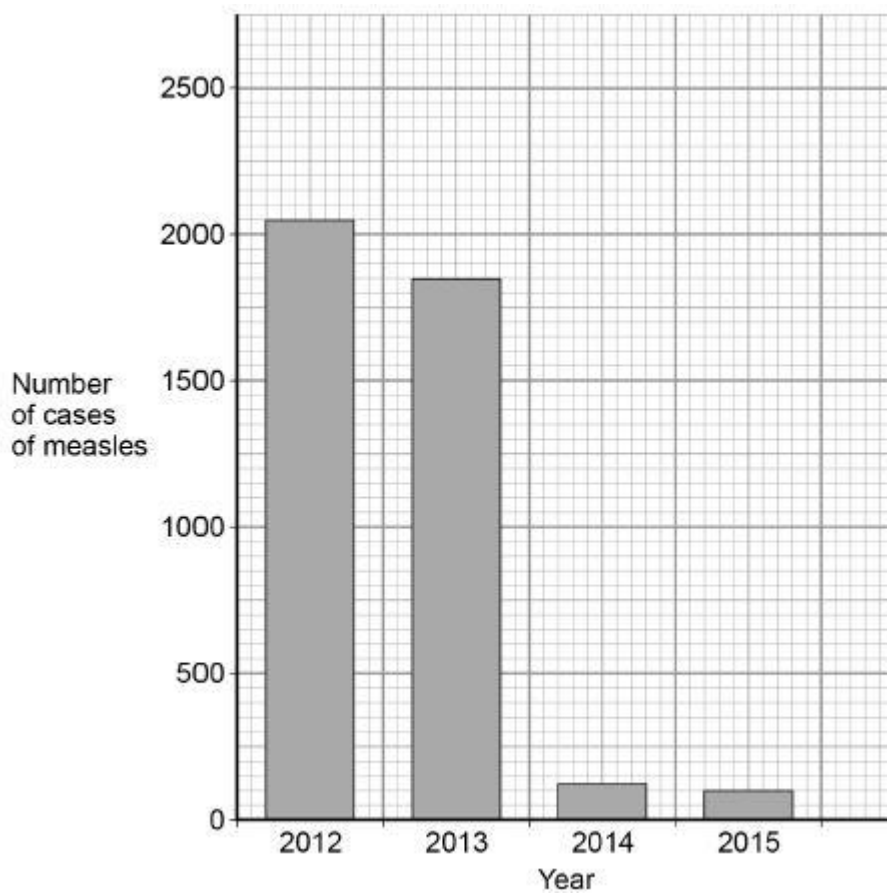
Produce toxins

(3)

Measles is a serious disease. A person can die from measles.

Figure 2 shows the number of cases of measles in England and Wales between 2012 and 2015

Figure 2



- (c) Use **Figure 2** to calculate the decrease in the number of cases of measles between 2012 and 2015

Answer = _____ cases

(2)

- (d) Suggest **one** reason for the decrease in the number of cases of measles between 2012 and 2015

(1)

(e) Antibiotics **cannot** be used to treat measles.

Suggest why.

(1)

(f) Gonorrhoea is a disease caused by a bacterium.

Gonorrhoea **can** be treated with antibiotics.

Give **one** other way to control the spread of gonorrhoea.

(1)

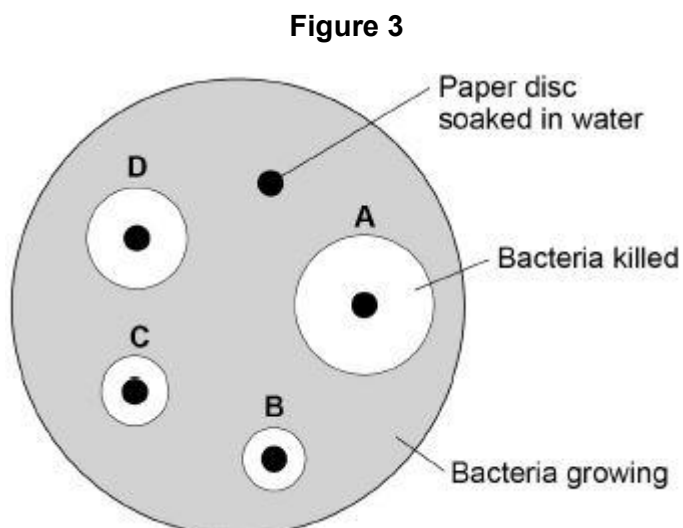
A scientist investigated how effective different antibiotics were at killing gonorrhoea bacteria.

This is the method used.

1. Grow gonorrhoea bacteria on agar in a Petri dish.
2. Place one paper disc soaked in water onto the agar.
3. Place four other paper discs, each soaked in a different antibiotic, **A**, **B**, **C**, and **D**, onto the agar.
4. Use the same sized paper discs and the same concentration of each antibiotic.
5. Incubate the Petri dish for 3 days.

Figure 3 shows the scientist's results.

A clear area around the disc means the antibiotic has killed the bacteria.



(g) Give **one** control variable the scientist used.

(1)

(h) Suggest why **one** disc was soaked in water.

(1)

(i) Which antibiotic in **Figure 3** would be the best to treat gonorrhoea?

Give a reason for your answer.

Antibiotic _____

Reason _____

(2)

(Total 13 marks)

Q3.

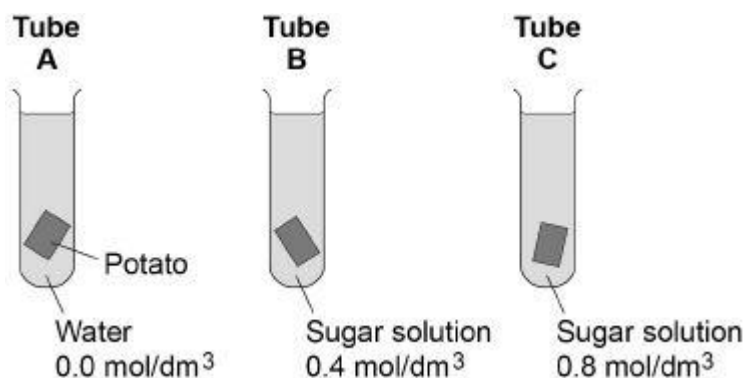
A student investigated the effect of different concentrations of sugar solution on pieces of potato.

This is the method used.

1. Cut three pieces of potato to the same length.
2. Dry each piece on a paper towel.
3. Weigh each piece.
4. Place each piece in a different concentration of sugar solution.
5. Leave all three pieces for 2 hours.
6. Remove the three pieces of potato from the solutions.
7. Dry each piece on a paper towel.
8. Measure the length and mass of each piece of potato.

Figure 1 shows how the investigation was set up.

Figure 1



(a) Why did the student dry each piece of potato before weighing it?

(1)

(b) What **two** changes would you expect in the potato in **tube A** after 2 hours?

Tick **two** boxes.

Breaks into pieces

Decrease in hardness

Decrease in size

Increase in mass

Increase in length

(2)

(c) Complete the sentences.

Water moves into and out of cells by a process called _____ .

Water would move _____ the potato cells in **tube A**.

The solution outside the potato in **tube A** is at a _____

concentration than the solution inside the potato cells.

(3)

(d) The potato in **tube B** did not change.

Give **one** conclusion that can be made from this observation.

(1)

(e) **Figure 2** shows the root of a germinating seed.

Figure 2



Describe **two** ways the root is adapted to absorb water efficiently.

1. _____

2. _____

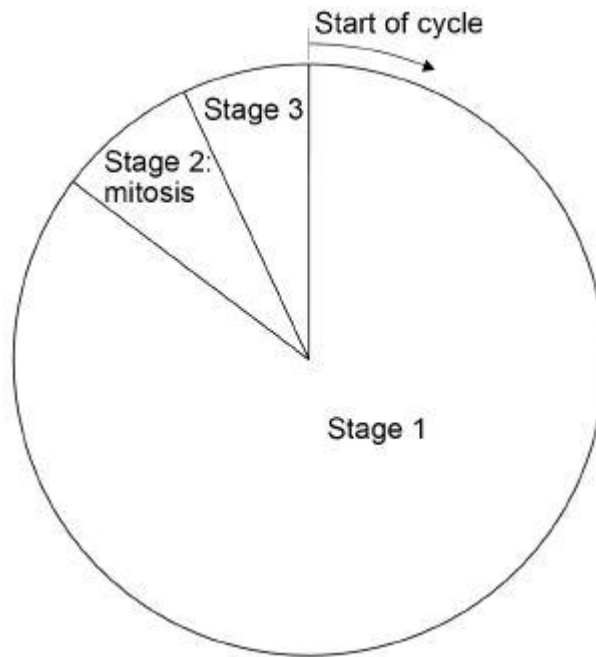
(2)
(Total 9 marks)

Q4.

Cells divide in a series of stages called the cell cycle.

Stage 2 of the cycle is mitosis.

The diagram below shows a simplified cell cycle for a human body cell.



(a) Draw **one** line from each stage in the cell cycle to what happens during that stage.

Stage in the cell cycle	What happens during that stage
Stage 1	Nucleus divides
Stage 2	Cell divides into two
Stage 3	Copies of the DNA are made

(2)

(b) The mass of DNA in a human body cell at the start of the cell cycle is 6 picograms.

What mass of DNA will be in each of the new cells produced by this cell division?

Tick **one** box.

3 picograms

6 picograms

9 picograms

12 picograms

(1)

(c) Stem cells are undifferentiated cells.

Which statement about stem cells is correct?

Tick **one** box.

Animal stem cells are found in meristems

Animal stem cells divide by meiosis

Meristem cells in plants can differentiate throughout the life of the plant

Meristem cells in plants can only differentiate into one type of cell

(1)

Stem cells from human embryos can differentiate into most types of human cell.

Research is being done into the use of embryonic stem cells in medical treatments.

The long-term effects of using embryonic stem cells in patients are not well understood.

In therapeutic cloning, human embryos are produced using a donated human egg cell and a cell from the patient.

- The embryo produced contains the same genetic information as the patient.
- Stem cells are taken from the embryo and stimulated to divide to form cells the patient needs.
- The embryo is then destroyed.

(d) Suggest **two** advantages of therapeutic cloning.

1. _____

2. _____

(2)

(e) Suggest **two** disadvantages of therapeutic cloning.

1. _____

2. _____

(2)

(Total 8 marks)

Q5.

This question is about cell structures.

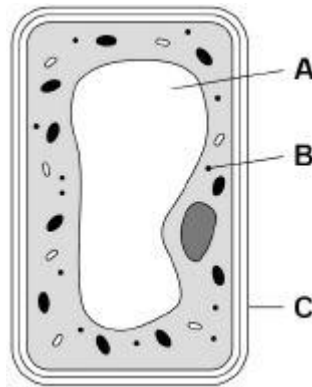
- (a) Draw **one** line from each cell structure to the type of cell where the structure is found.

Cell Structure	Type of cell where the structure is found
Nucleus	Prokaryotic cells
Permanent vacuole	Plant cells only
Plasmid	Eukaryotic cells

(2)

- (b) **Figure 1** shows a plant cell.

Figure 1



What are the names of structures **A**, **B** and **C**?

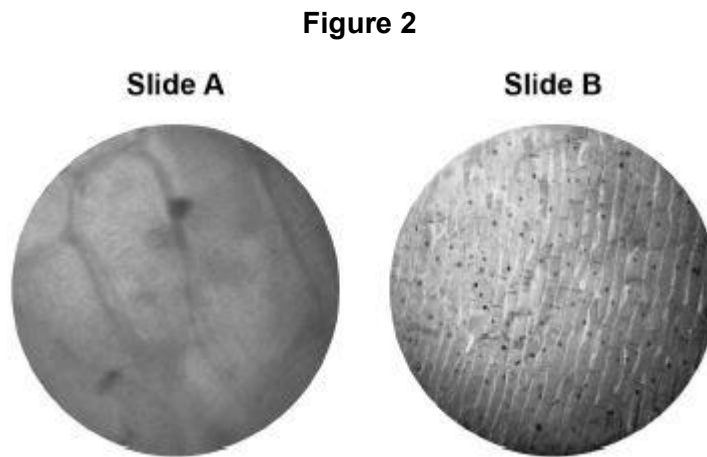
Tick **one** box.

Structure A	Structure B	Structure C	
Chloroplast	Vacuole	Cell wall	<input type="checkbox"/>
Nucleus	Chloroplast	Cell membrane	<input type="checkbox"/>
Vacuole	Mitochondrion	Cell membrane	<input type="checkbox"/>
Vacuole	Ribosome	Cell wall	<input type="checkbox"/>

(1)

A student observed slides of onion cells using a microscope.

Figure 2 shows two of the slides the student observed.



The cells on the slides are **not** clear to see.

- (c) Describe how the student should adjust the microscope to see the cells on Slide A more clearly.

(1)

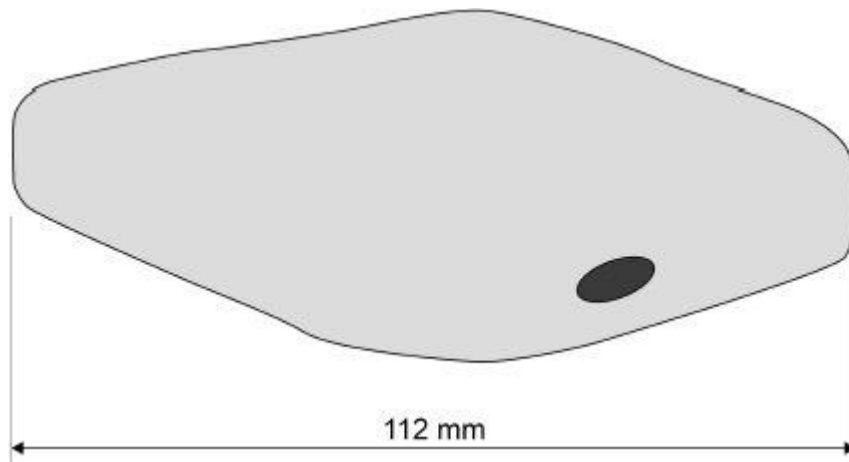
- (d) Describe how the student should adjust the microscope to see the cells on Slide B more clearly.

(2)

(e) The student made the necessary adjustments to get a clear image.

Figure 3 shows the student's drawing of one of the cells.

Figure 3



The real length of the cell was 280 micrometres (μm).

Calculate the magnification of the drawing.

Magnification = \times _____

(3)

(Total 9 marks)

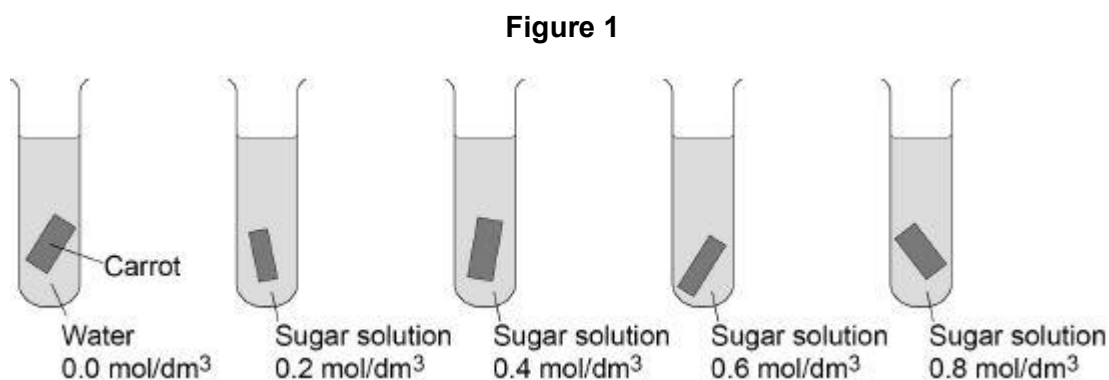
Q6.

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

This is the method used.

1. Weigh five pieces of carrot.
2. Place each piece into a different tube.
3. Into each tube add 20 cm³ of water or one of the sugar solutions as shown in **Figure 1**
4. Leave the apparatus for 2 hours.
5. Remove the carrot and dry each piece on paper towel.
6. Reweigh each piece.
7. Calculate the percentage (%) change in mass of each piece.

Figure 1 shows how the investigation was set up.



The table below shows the results.

Concentration of sugar solution in mol/dm ³	Percentage (%) change in mass
0.0	+24
0.2	+12
0.4	+1
0.6	-8
0.8	-15

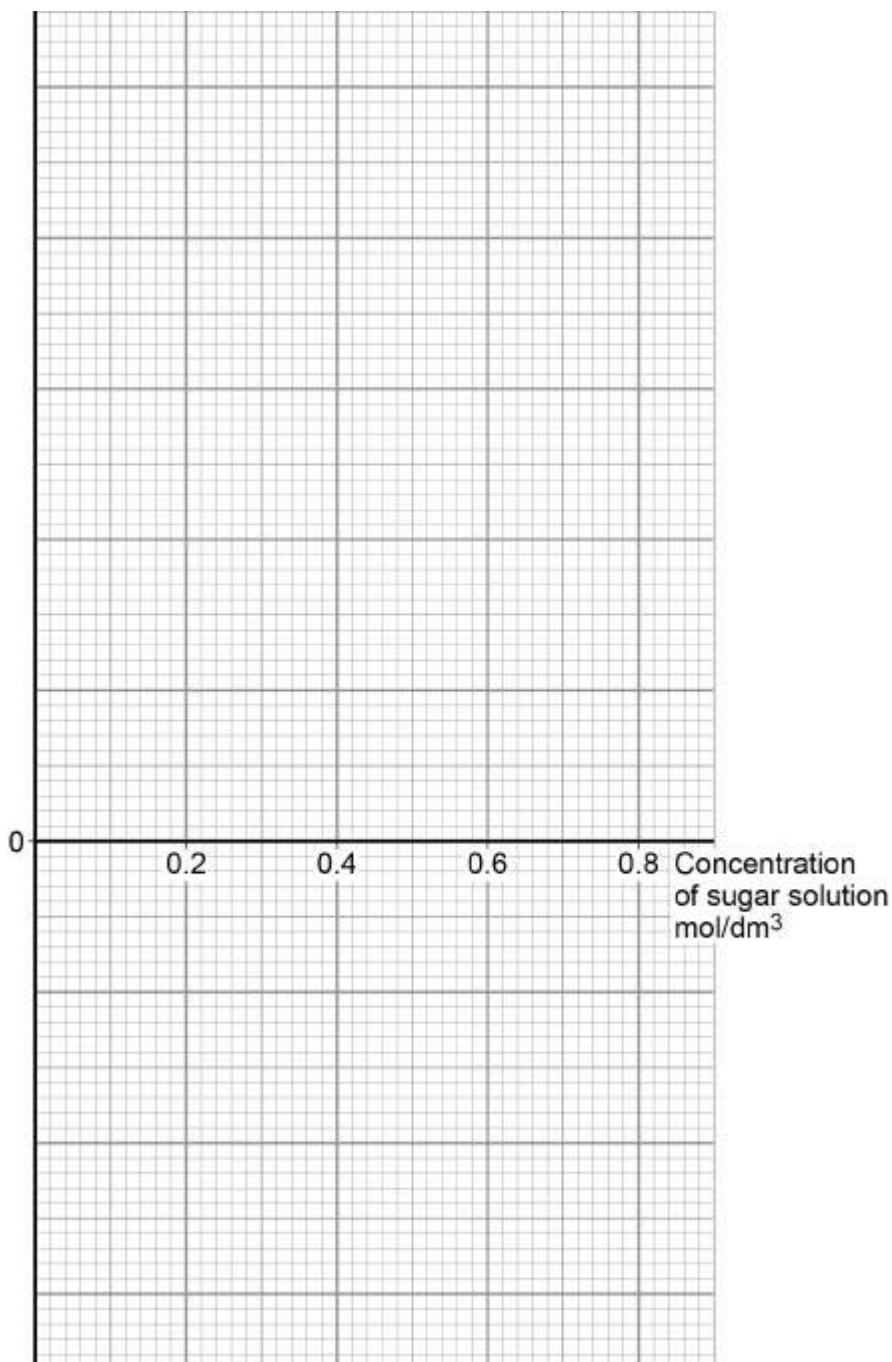
- (a) Suggest why the student calculated the percentage (%) change in mass of each piece of carrot.

(1)

(b) Complete **Figure 2** using the results in the table above

- Choose a suitable scale and label for the y-axis.
- Plot the results.
- Draw a line of best fit.

Figure 2



(4)

(c) Estimate the concentration of sugar solution inside the carrot cells.

Use your completed graph on **Figure 2**

Concentration = _____ mol/dm³

(1)

(d) Explain why the mass of the carrot in the 0.6 mol/dm^3 sugar solution changed.

(4)

(e) The student repeated the investigation using boiled pieces of carrot.

The pieces of carrot did **not** change in mass.

Suggest why.

(1)

(Total 11 marks)

Mark schemes

Q1.

(a) $50 = \frac{43}{\text{size of real object}}$ 1

(size of real object =) $\frac{43}{50}$ 1

(size of real object =) 0.86 (mm) 1

(size of real object =) 860 (μm)
an answer of 860 (μm) scores 4 marks
allow correct conversion of their calculated value
if no other marks awarded allow 1 mark for
 magnification = $\frac{\text{size of image}}{\text{size of real object}}$ 1

(b) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account. 3-4

Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear. 1-2

No relevant content 0

Indicative content

- place slide on stage
- use lowest power / $\times 4$ objective lens (initially)
- adjust mirror **or** switch light on so light passes through slide
- move stage as close to lens as possible
- slide must not touch lens
- turn focussing knob so slide moves away from lens
- turn focussing knob until image comes into focus
- use fine focus to get clear image
- change objective lens to $\times 10$
- $\times 5$ eyepiece and $\times 10$ objective lenses (gives total magnification of $\times 50$)
- refocus slide using focussing knob

For Level 2 reference to how to focus the slide / cells **and** achieve magnification of $\times 50$ is required

(c) any **three** from:

- (rate) fastest in the first 0.5 hours
allow fastest rate is 120 units per hour (at start)

- (rate gradually) decreases after first 0.5 hours
allow mean rate over 3.5 hours is 37.14 units per hour
- **or**
- (rate gradually) decreases throughout the investigation
- rate is constant between 1.0 and 2.0 hours
- **or**
- rate is constant between 2.0 and 3.5 hours
- (rate) becomes zero between 3.0 and 3.5 hours
allow (rate) is zero after 3.5 hours
allow 'it' for rate

3

- (d) more nitrate ions are absorbed in the presence of oxygen
allow nitrate ions absorbed faster in the presence of oxygen

1

(which suggests) they are absorbed by active transport / uptake

1

which requires energy from respiration

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

1

some nitrate ions absorbed by diffusion

or

some nitrate ions absorbed (by active transport / uptake) requiring energy from anaerobic respiration

or

some nitrate ions absorbed by active transport / uptake using oxygen already dissolved in the solution

1

- (e) nitrate ions are used with glucose

1

to form amino acids

1

(which are) used to synthesise proteins (needed for growth)

1

[18]

Q2.

- (a) cell membrane
extra ticks negates marks

1

- (b) engulf pathogens

1

produce antibodies

1

produce antitoxins

1

extra ticks negates marks

(c) 2050 – 100

1

= 1950

allow 1 mark for a correct subtraction of incorrect values

1

an answer of 1950 scores 2 marks

(d) any **one** from:

- (more) people vaccinated

ignore injections / treatments / medicines unqualified

allow vaccine produced

allow (more people given) MMR (vaccine)

*do **not** allow antibiotics*

ignore less people infected

- (more) people immune
- no new measles strain

1

(e) any **one** from:

- measles is (caused by) a virus

allow measles is not caused by a bacterium

- viruses cannot be killed / destroyed by antibiotics

*allow antibiotics **only** kill / destroy bacteria*

ignore harmed / treated

1

(f) any **one** from:

- use of a barrier method of contraception

ignore use of diaphragm

- use of a condom

ignore use protection / safe sex

- vaccination / immunisation

- avoid sexual intercourse / contact

*do **not** accept less sexual intercourse / contact*

1

(g) any **one** from:

- size / shape/ type of paper disc

ignore paper disc unqualified

- concentration of antibiotic

allow strength / dosage of antibiotic

- volume / amount of antibiotic

- (incubation) time

allow 3 days

- (incubation) temperature

ignore size of petri dish

- (h) to check that the disc / water did not have an effect
or
to make sure it was the antibiotic that had an effect
allow for comparison with the antibiotics
allow as a (experimental) control
*do **not** accept as a control variable*

1

1

- (i) (antibiotic) **A**
no marks if wrong antibiotic given

1

any **one** from:

- (antibiotic **A**) had the **largest** clear area around it
- (antibiotic **A**) killed the **most** bacteria

1

[13]

Q3.

- (a) any **one** from:
- water on potato would increase mass
allow so only the mass of the potato is measured
 - to control amount of water on potato
allow to remove water from outside of potato
allow liquid / solution / sugar solution for water
allow so you get the correct (starting) mass of the potato
*do **not** accept so that all the pieces of potato weighed the same*

1

- (b) increase in mass

1

increase in length

1

extra ticks negates marks

- (c) osmosis

allow diffusion

1

into

allow inside
*do **not** accept through*

1

lower

allow low / more dilute / dilute

1

in this order only

- (d) any **one** from:
- the concentration (of sugar solution) in the cells is 0.4 (mol/dm³)
 - the concentration (of sugar solution) in the cells is the same as the solution (in the tube)

1

allow reference to potato instead of cells

- (e) any **two** from:

- has (root) hairs

allow root hair cells

- large surface / area

allow wide surface area

- (root) hairs extend into soil

allow (root) hairs are long / widespread

- (root) hairs have thin walls

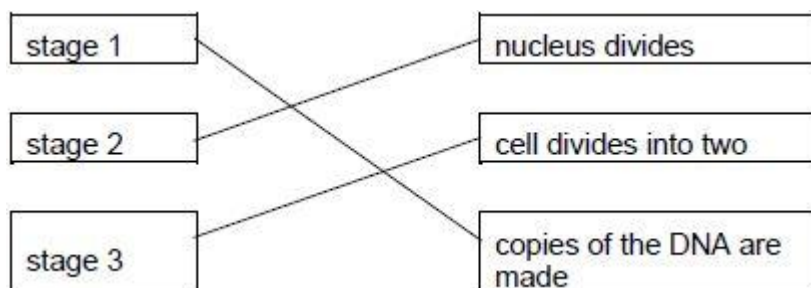
2

ignore references to active transport and mineral uptake

[9]

Q4.

- (a)



allow 1 mark for 1 or 2 correct

credit can be given where students have matched the boxes correctly, for example numbering the boxes

2

- (b) 6 picograms

1

- (c) meristem cells in plants can differentiate throughout the life of the plant

1

- (d) any **two** from:

- may cure / treat diseases

or

cure medical conditions

or

produce replacement cells / tissues / organs

allow example e.g. diabetes / paralysis

allow cells can be stored for future use

ignore used in medical treatments

ignore patient makes / grows cells / tissues / organs

- cells unlikely to be **rejected** by patient)
ignore same genetic information
- cells / tissues of any type can be produced
ignore differentiated into most types of cells
- many cells produced
- cells produced could be used for research
- would reduce waiting time for transplants

2

ignore references to cost
ignore all reference to producing babies / IVF

(e) any **two** from:

- (potential) life is killed / destroyed
allow embryo is killed
ignore embryo is destroyed
ignore embryo is a life / becomes a baby
- shortage of donors / eggs
- egg donation / collection has risks
- do not yet know risks / side effects of the procedure on the patient
ignore long term effects are not well understood
allow may cause tumours / cancer
- may transfer (viral) infection
- poor success rate
allow in terms of viable egg / embryo / cell / tissue / organ production

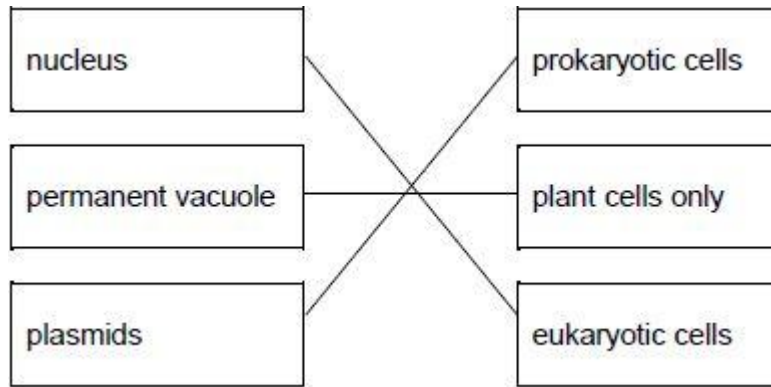
2

ignore references to cost
ignore unethical unqualified
Ignore reference to religion / beliefs

[8]

Q5.

(a)



allow 1 mark for one or two correct links

2

(b)

vacuole	ribosome	cell wall
---------	----------	-----------

*tick box takes precedence
if no tick is given, look at both the figure and the
circling of words in the table
if writing is seen on the figure and in the table
both must be correct*

1

(c) turn the (fine focusing) knob until the cells are in focus

*allow focus it
do **not** accept increase magnification
ignore decrease magnification
ignore clear
ignore references to resolution / illumination
ignore zoom in / out*

1

(d) (rotate the) nosepiece / objective lens

allow change the (objective / eyepiece) lens

1

to a higher power (lens)

*allow (to) increase the magnification
a comparator is required
ignore change / adjust the magnification
allow stronger or more powerful lens
ignore references to resolution / illumination
unqualified
ignore zoom in / out
ignore references to an electron microscope*

1

(e) conversion of units:
(112 mm →) 112 000 (µm)
or
(280 µm →) 0.28 (mm)

1

$$(\text{magnification} =) \frac{112}{0.28}$$

or

$$(\text{magnification} =) \frac{112000}{280}$$

allow 1 mark for no conversion of units 112 / 280

or

incorrect value from step 1 correctly substituted

1

400 (×)

do **not** accept if units are given

if no other mark scored allow 1 mark for:

$$\text{magnification} = \frac{\text{size of image}}{\text{size of real object}}$$

a triangle with words or letters in is insufficient,
as the correct rearrangement is needed

1

an answer of 400 (×) scores 3 marks

[9]

Q6.

- (a) to control for the starting mass (of the pieces of carrot)

allow because the pieces of carrot were not all
the same mass at the start

do **not** accept were not all the same size

do **not** accept as a control variable

1

- (b) suitable scale **and** label for y-axis

allow 5 or 6 per 2 cm

do **not** accept 5 per 1 cm

1

all points plotted correctly

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

allow 1 mark for 4 correct points

2

line of best fit

conc. ...	percentage (%) change...
0.0	+24
0.2	+12
0.4	+1
0.6	-8
0.8	-15

- 1
- (c) value from student's line of best fit
allow $\pm \frac{1}{2}$ a square
- 1
- (d) mass decreased
- 1
- (due to) **loss of water by osmosis**
ignore diffusion
- 1
- through a partially / selectively / semi permeable membrane
- 1
- a clear reference to concentration of water or concentration of sugar is required for the fourth mark*
- (as) concentration of sugar solution is greater than concentration of sugar (solution) inside cells / carrot
allow (as) concentration of sugar solution inside cells / carrot is lower than the concentration of sugar solution (in the tube or around the carrot)
- or**
- (as) the concentration of water is less outside the cells / carrot than the concentration inside the cells / carrot
allow answers in terms of dilute and concentrated solutions
- 1
- (e) the (partially permeable / cell) membrane was damaged
*allow idea that cell membrane is no longer intact
or is **more permeable** / leaky
allow the membrane is denatured
ignore cells are dead*

1

[11]