

Cell Structure

These practice questions can be used by students and teachers and is suitable for GCSE AQA Biology topic Questions 8641

Level: GCSE AQA Biology 8641

Subject: Biology

Exam board: GCSE AQA

Topic: Cell Structure

Q1.

This question is about the cell cycle.

- (a) Chromosomes are copied during the cell cycle.

Where are chromosomes found?

Tick **one** box.

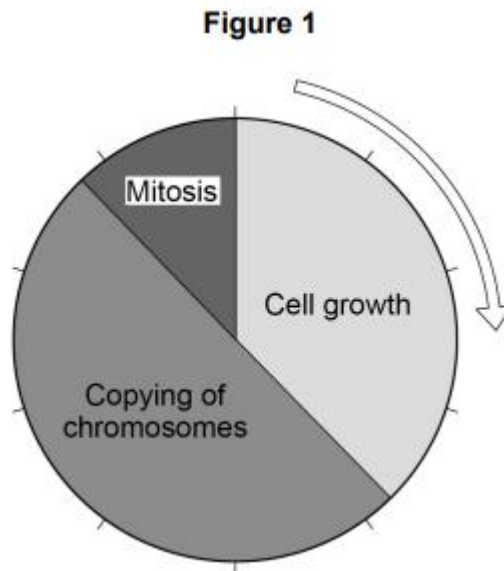
Cytoplasm	<input type="checkbox"/>
Nucleus	<input type="checkbox"/>
Ribosomes	<input type="checkbox"/>
Vacuole	<input type="checkbox"/>

(1)

- (b) What is the name of a section of a chromosome that controls a characteristic?

(1)

Figure 1 shows information about the cell cycle.



(c) Which stage of the cell cycle in **Figure 1** takes the most time?

Tick **one** box.

- | | |
|------------------------|--------------------------|
| Cell growth | <input type="checkbox"/> |
| Copying of chromosomes | <input type="checkbox"/> |
| Mitosis | <input type="checkbox"/> |

(1)

(d) During mitosis cells need extra energy.
Which cell structures provide most of this energy?

Tick **one** box.

- | | |
|--------------|--------------------------|
| Chromosomes | <input type="checkbox"/> |
| Cytoplasm | <input type="checkbox"/> |
| Mitochondria | <input type="checkbox"/> |
| Ribosomes | <input type="checkbox"/> |

(1)

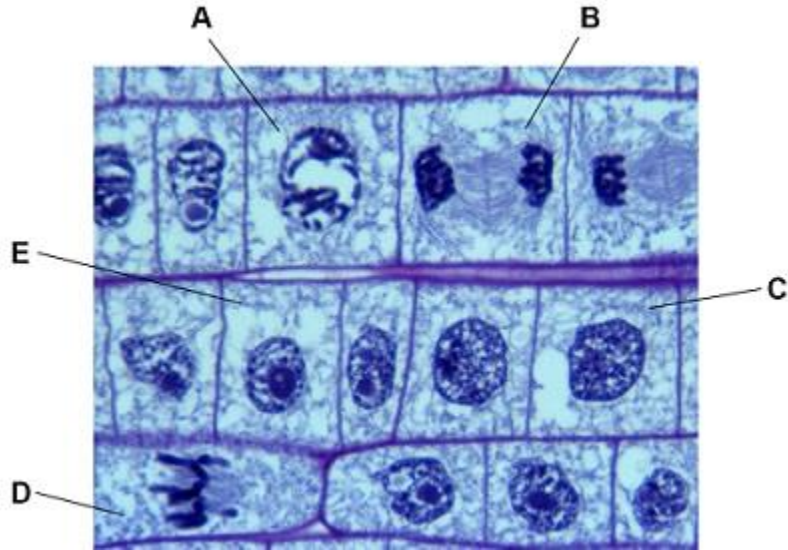
(e) The cell cycle in **Figure 1** takes two hours in total.
The cell growth stage takes 45 minutes.

Calculate the time taken for mitosis.

Time = _____ minutes

(2)

Figure 2 shows some cells in different stages of the cell cycle.



(f) Which cell is **not** dividing by mitosis

Tick **one** box.

A	B	C	D
---	---	---	---

(1)

(g) Cell **E** in **Figure 2** contains 8 chromosomes.

Cell **E** divides by mitosis.

How many chromosomes will each new cell contain?

Tick **one** box.

2	<input type="checkbox"/>
4	<input type="checkbox"/>
8	<input type="checkbox"/>
16	<input type="checkbox"/>

(1)

(h) Why is mitosis important in living organisms?

Tick **one** box.

- To produce gametes
- To produce variation
- To release energy
- To repair tissues

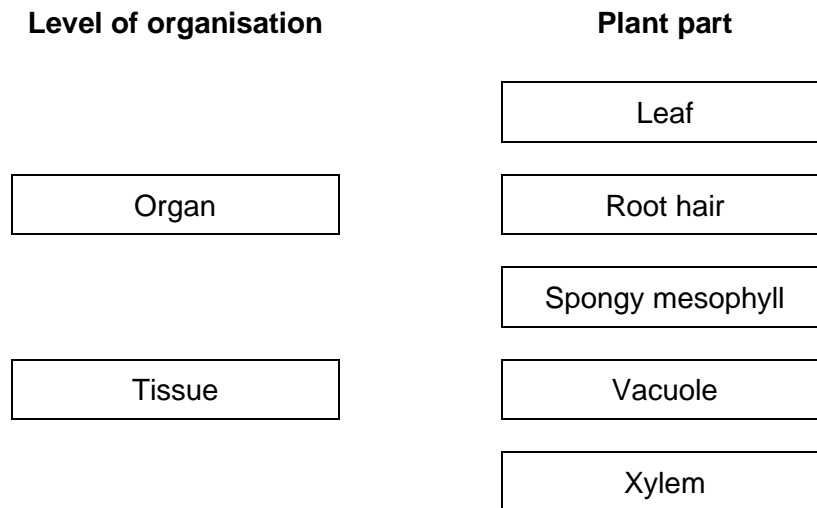
(1)

(Total 9 marks)

Q2.

Plants are made up of cells, tissues and organs.

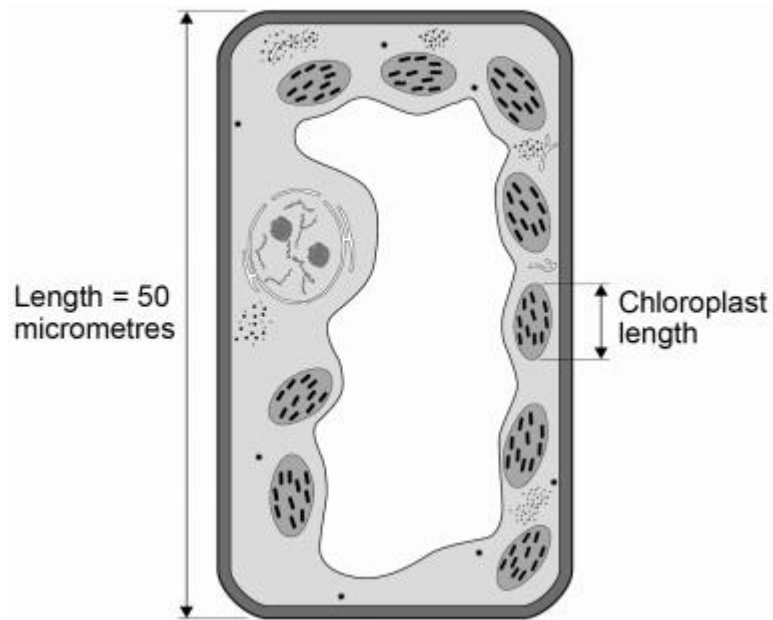
(a) Draw **one** line from each level of organisation to the correct plant part.



(2)

Figure 1 shows a plant cell drawn to scale.

Figure 1



(b) Where in a plant would the cell in **Figure 1** be found?

Tick **one** box.

- Epidermis
- Palisade mesophyll
- Phloem
- Xylem

(1)

(c) Calculate the length of the chloroplast labelled in **Figure 1**.

Length = _____ micrometres

(2)

(d) Cells in plant roots do **not** photosynthesise.

Give **one** reason why.

(1)

(e) As a plant grows, new root hair cells are formed from unspecialised cells.

How does an unspecialised cell become a new root hair cell?

Tick **one** box.

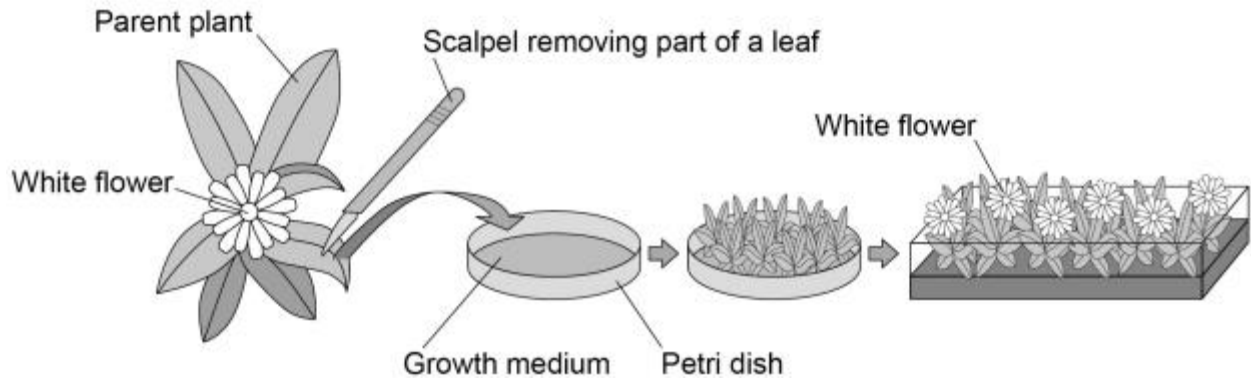
- | | |
|-----------------|--------------------------|
| Differentiation | <input type="checkbox"/> |
| Metabolism | <input type="checkbox"/> |
| Transpiration | <input type="checkbox"/> |
| Transport | <input type="checkbox"/> |

(1)

Scientists can clone plants using tissue culture.

Figure 2 shows the process of tissue culture.

Figure 2



(f) Why might scientists want to clone plants?

Tick **one** box.

To create new species of plants.

To introduce variation into plants.

To protect endangered plants from extinction.

To reduce disease resistance in plants.

(1)

(g) What is the advantage of cloning plants using tissue culture?

Tick **one** box.

No special equipment is needed.

Plants can be produced quickly.

The flowers are all different colours.

The offspring are all genetically different.

(1)

(h) The growth medium in **Figure 2** helps the plants to grow.

Name **one** substance in the growth medium.

(1)

(Total 10 marks)

Q3.

Eating food containing *Salmonella* bacteria can cause illness.

(a) Two symptoms of infection by *Salmonella* are vomiting and diarrhoea.

What causes these symptoms?

(1)

(b) Give **two** ways a person with a mild infection of *Salmonella* can help prevent the spread of the bacteria to other people.

1.

2.

(2)

(c) In very serious infections of *Salmonella*, a doctor can prescribe drugs to kill the bacteria.

What type of drug can the doctor prescribe to kill the bacteria?

(1)

- (d) A person with AIDS may take longer than a healthy person to recover from a *Salmonella* infection.

Explain why.

(2)

- (e) *Salmonella* bacteria can be transmitted from chickens to humans. Chickens can be vaccinated to prevent the transmission of *Salmonella* bacteria to humans.

Suggest **one** other way farmers could prevent the transmission of *Salmonella* from chickens to humans.

(1)

A restaurant owner employed a scientist to test the effectiveness of two kitchen cleaning liquids.

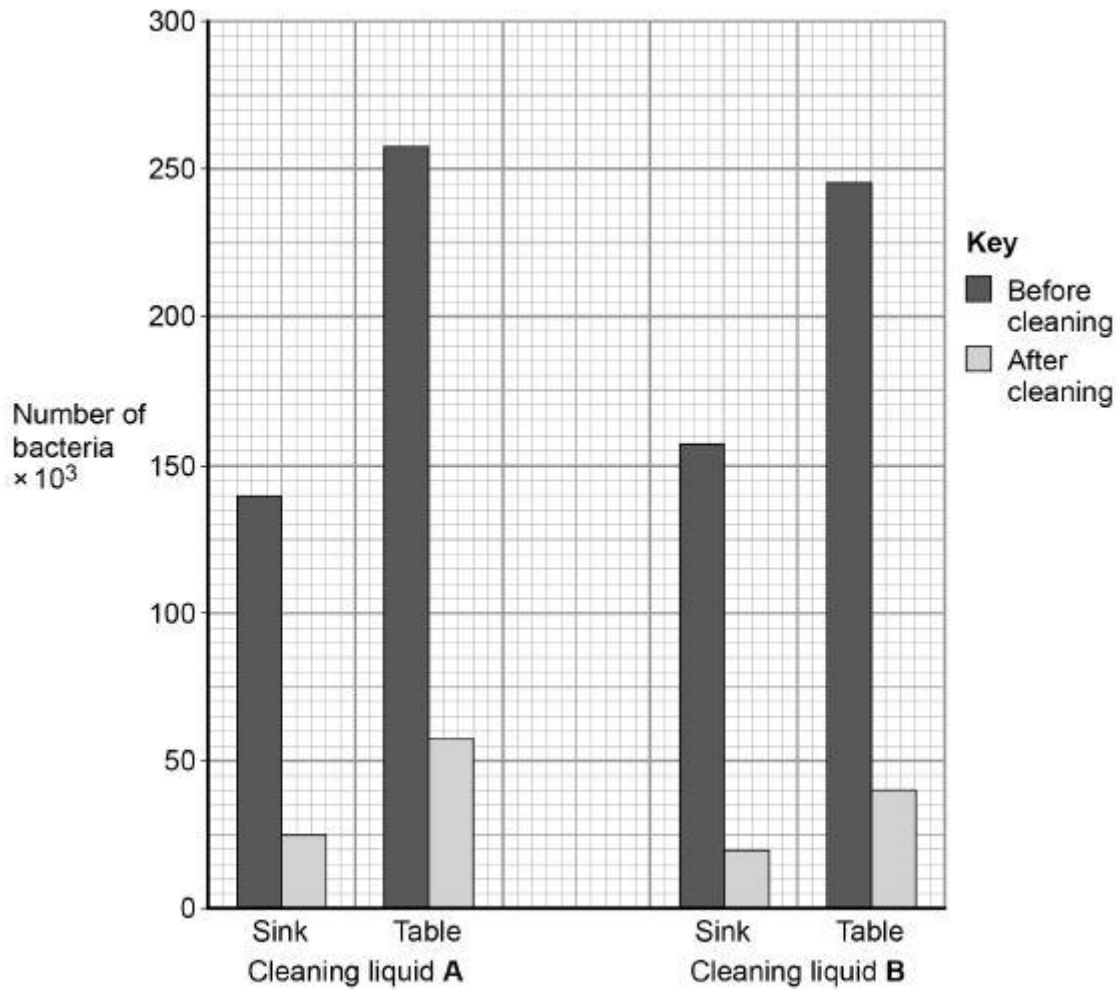
The scientist took samples from two work surfaces:

- before the surfaces had been cleaned with the cleaning liquids
- after the surfaces had been cleaned with the cleaning liquids.

The samples were then analysed for the number of bacteria they contained.

The results are shown in **Figure 1**.

Figure 1



(f) Which cleaning liquid is the more effective?

Give a reason for your answer.

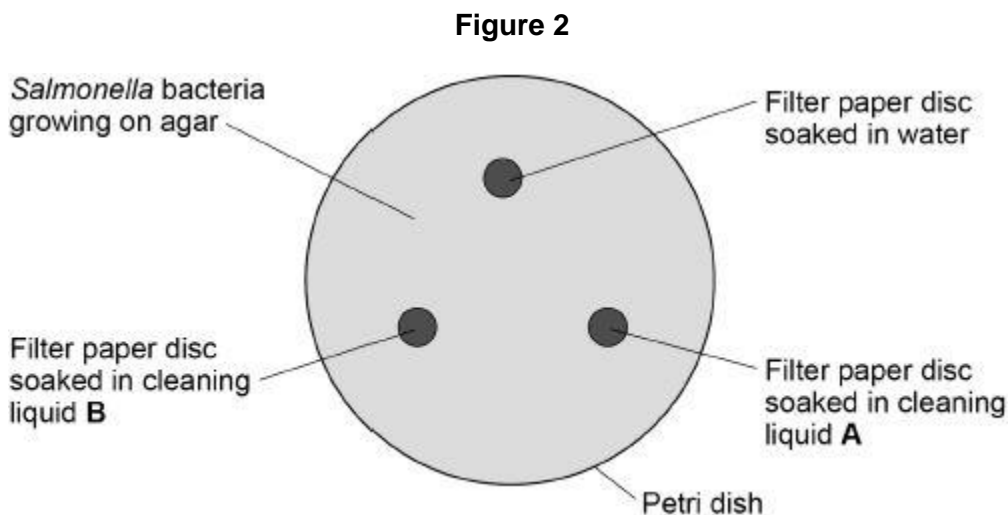
Cleaning liquid _____

Reason

(1)

The scientist investigated the effect of cleaning liquid **A** and cleaning liquid **B** on *Salmonella* bacteria grown in a laboratory.

Figure 2 shows the way the investigation was set up.



The Petri dish was placed in an incubator at 25 °C for 48 hours.

After 48 hours, the scientist calculated the area around each paper disc where no bacteria were growing.

The results are shown in the table below.

Filter paper disc	Area around disc with no bacteria growing in cm ²
Water	0
Cleaning liquid A	11
Cleaning liquid B	13

- (g) What measurement would the scientist need to take to calculate the area where no bacteria were growing?

(1)

- (h) Give **one** change to the investigation that would allow the scientist to check if the results are repeatable.

(1)

- (i) The scientist showed the results to the restaurant owner.

Both cleaning liquids cost the same per dm^3 .

Suggest **one** other factor the restaurant owner should consider when choosing which cleaning liquid to use.

(1)

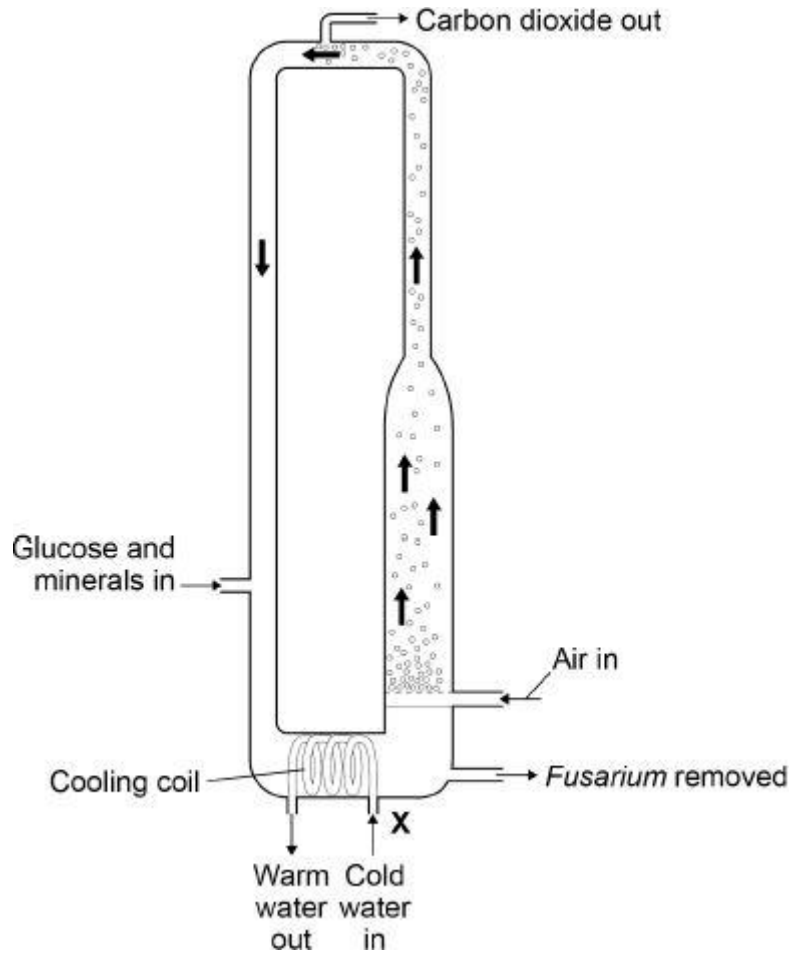
(Total 11 marks)

Q4.

Mycoprotein is a protein-rich food.

Mycoprotein is made from the fungus *Fusarium*.

The diagram below shows a fermenter used for growing *Fusarium*.



(a) Explain why the fermenter is sterilised before use.

(2)

(b) Cold water is pumped through the cooling coil at point **X**.

This maintains a constant temperature inside the fermenter.

Suggest the temperature at which *Fusarium* grows fastest.

Tick **one** box.

5 °C	<input type="checkbox"/>
20 °C	<input type="checkbox"/>
30 °C	<input type="checkbox"/>
85 °C	<input type="checkbox"/>

(1)

(c) Glucose and bubbles of air enter the fermenter.

The bubbles of air supply oxygen.

Explain why *Fusarium* needs glucose and oxygen.

(2)

(d) The bubbles of air also move materials around the fermenter.

Suggest why it is useful for bubbles of air and materials to move around inside the fermenter.

(2)

(e) 100 grams of chicken meat contains 22 grams of protein.

100 grams of mycoprotein contains 11 grams of protein.

A man ate 100 grams of chicken in one meal.

How many grams of mycoprotein would the man need to eat to get the same mass of protein as in 100 grams of chicken?

Tick **one** box.

100 grams	<input type="checkbox"/>
110 grams	<input type="checkbox"/>
200 grams	<input type="checkbox"/>
220 grams	<input type="checkbox"/>

(1)
(Total 8 marks)

Q5.

Cells can be classified according to their structure.

(a) Complete **Table 1** to show which features each cell type has.

Write a tick or a cross in each box.

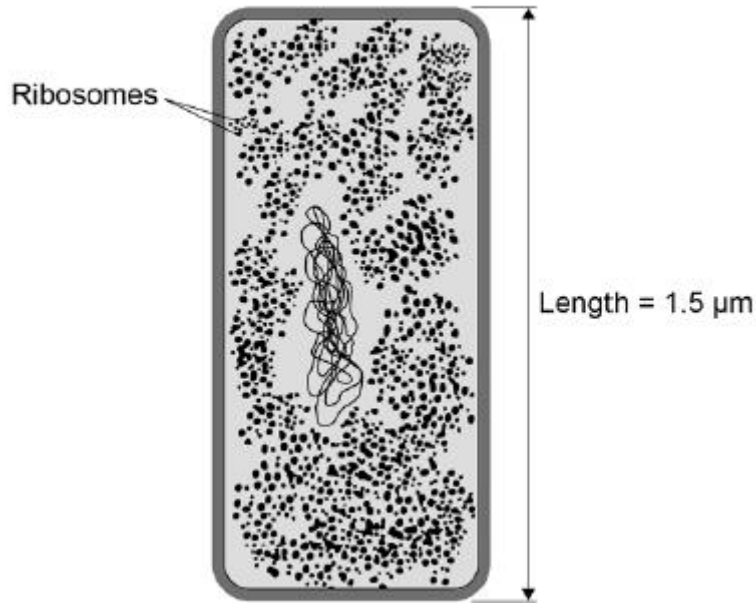
Table 1

	Nucleus	Plasmids	Cytoplasm
Prokaryotic cell			
Eukaryotic cell			

(2)

Figure 1 shows a cell.

Figure 1



(b) What type of cell is shown in **Figure 1**.

Tick **one** box.

An animal cell

A bacterial cell

A plant cell

(1)

(c) The cell in **Figure 1** contains ribosomes.

What is the function of ribosomes?

(1)

(d) There are 1000 micrometres (μm) in a millimetre (mm).

The length of the cell in **Figure 1** is 1.5 micrometres (μm).

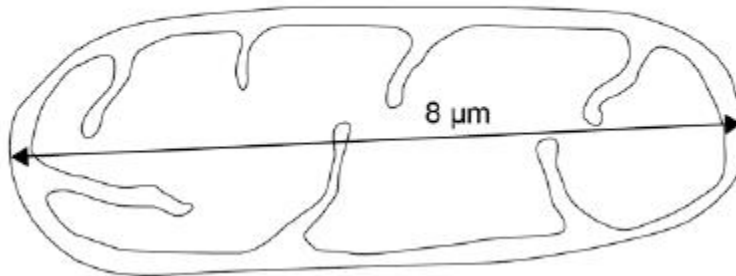
Give the length of the cell in millimetres (mm).

Length of cell = _____ mm

(1)

Figure 2 shows a mitochondrion viewed with a microscope.

Figure 2



(e) Give **one** reason why the cell in **Figure 1** does **not** contain mitochondria.

Use information from **Figure 1** and **Figure 2**.

(1)

The cell in **Figure 1** divides once every 30 minutes.

Table 2 shows how many cells are present after a given time.

Table 2

Time in minutes	Number of cells present
0	1

30	2
60	4

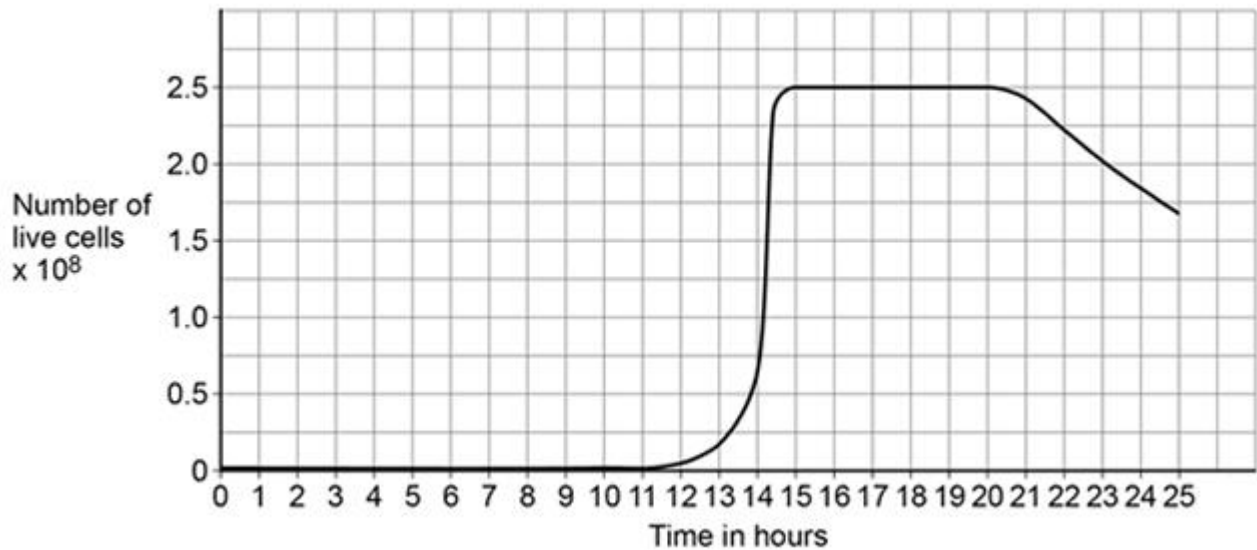
(f) Calculate how many cells will be present after 2 hours.

Number of cells = _____

(2)

Cells like the one in **Figure 1** are kept in a culture solution for 25 hours.

The graph below shows the number of live cells present.



(g) Describe the changes in the number of live cells shown in the graph above in the first 20 hours.

Use data from the graph in your answer.

(3)

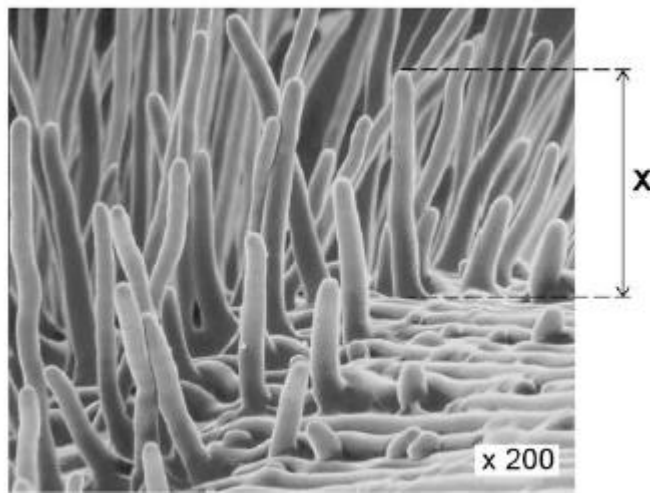
(h) Suggest **one** reason why the number of live cells decreases after 20 hours.

(1)

(Total 12 marks)

Q6.

The image below shows part of a root from a cress plant.



(a) What type of microscope was used to create the image above?

(1)

(b) The magnification of the cress root in the image above is $\times 200$.
There are 1000 micrometres (μm) in a millimetre (mm).

Calculate the real length of the root hair, **X**.

Give your answer in micrometres (μm).

Real length **X** = _____ μm

(2)

(c) Root hair cells take up water from the soil.

Explain **one** way in which the root hair cell is adapted to this function.

(2)

The table shows the water uptake by a plant's roots on two different days.

Mean water uptake in cm^3 per hour	
Cold day	1.8

Hot day	3.4
---------	-----

- (d) Explain why the mean rate of water uptake is higher on a hot day than on a cold day.

(3)

- (e) The concentration of mineral ions in the soil is lower than in root hair cells.
Root hair cells take up mineral ions from the soil.
Root hair cells contain mitochondria.

Explain why root hair cells contain mitochondria.

(4)
(Total 12 marks)

Q7.

A student carried out an investigation using leaf epidermis.

This is the method used.

1. Peel the lower epidermis from the underside of a leaf.
2. Cut the epidermis into six equal sized pieces.
3. Place each piece of lower epidermis into a different Petri dish.
4. Add 5 cm³ of salt solution to the six Petri dishes. Each Petri dish should have a different concentration of salt solution.
5. After 1 hour, view each piece of epidermis under a microscope at $\times 400$ magnification.
6. Count and record the total number of stomata present and the number of open stomata that can be seen in one field of view.

The student's results are shown in the table.

Concentration of salt solution in mol / dm ³	Number of stomata in field of view	Number of open stomata in field of view	Percentage (%) of open stomata in field of view
0.0	7	7	100
0.1	8	8	100
0.2	7	6	X
0.3	9	6	67
0.4	10	4	40
0.5	9	2	22

- (a) Calculate value **X** in the table above.

X = _____ %

(1)

(b) Give **one** conclusion from the results in the table above.

(1)

(c) How could the student find out what concentration of salt solution would result in half of the stomata being open?

(1)

(d) The student measured the real diameter of the field of view to be 0.375 mm.

Calculate the number of open stomata per mm^2 of leaf for the epidermis placed in 0.4 mol / dm^3 salt solution.

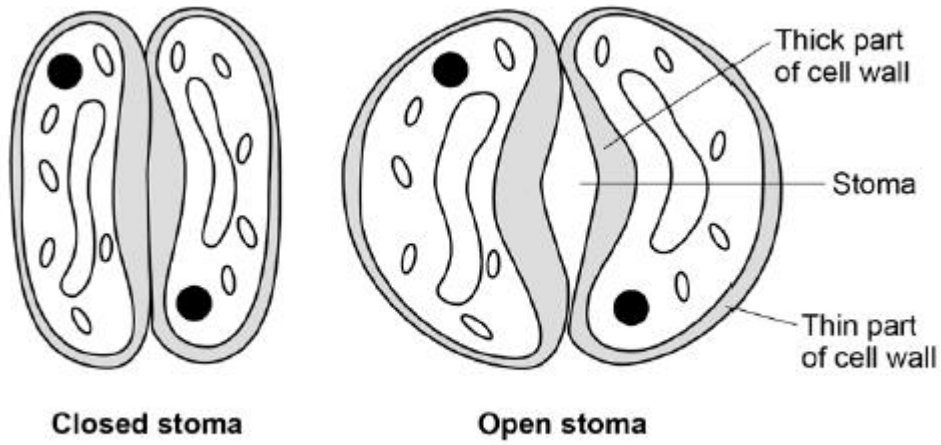
Use information from the table above.

Take π to be 3.14

Number of open stomata = _____ per mm^2

(3)

- (e) The diagram below shows two guard cells surrounding a closed stoma and two guard cells surrounding an open stoma.



When light intensity is high potassium ions are moved into the guard cells.

Describe how the movement of potassium ions into the guard cells causes the stoma to open.

(4)
(Total 10 marks)

Q8.

Fresh milk contains bacteria.

Some students investigated decay caused by the bacteria in fresh milk.

This is the method used:

1. Put 200 cm³ of fresh milk in a sterilised flask.
2. Leave the flask for 3 days at 20 °C.
3. Measure the pH of the milk each day using universal indicator paper.

Figure 1 and **Figure 2** show the apparatus the students used.

Figure 1

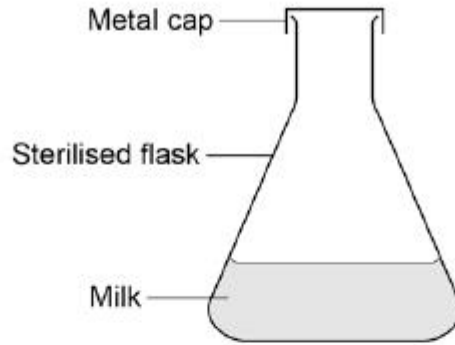
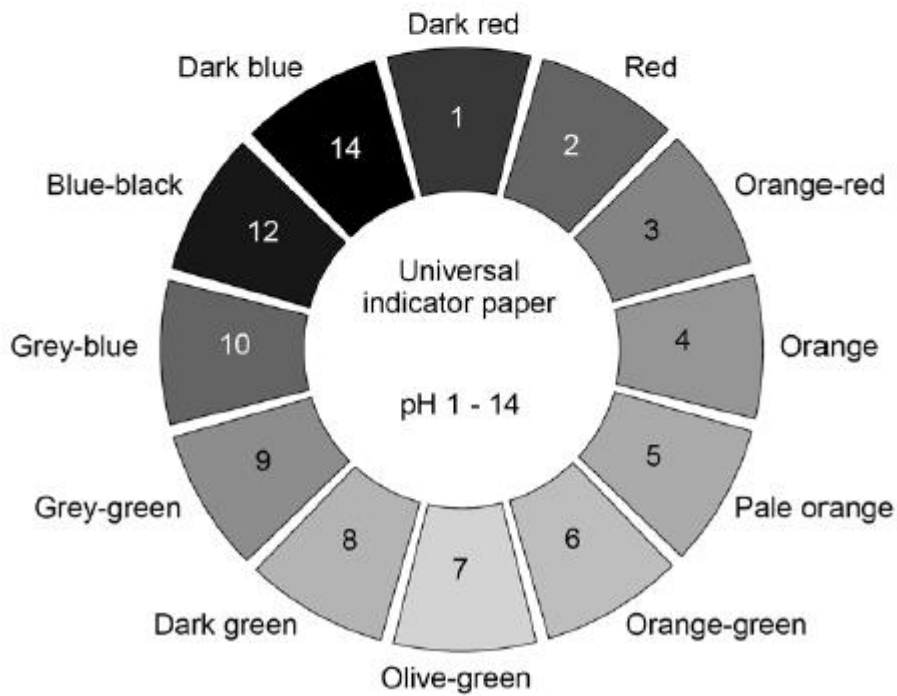


Figure 2



- (a) Give **one** reason why the students sterilised the flask before adding the milk.

(1)

- (b) Describe how the students could sterilise the flask in a school laboratory.

(2)

(c) Why did the students put a cap on top of the flask?

(1)

(d) The table shows the students' results.

Table 1

Time in days	Colour of universal indicator paper	pH
0	Olive-green	
1	Olive-green	
2	Olive-green	
3	Orange-green	

Complete **Table 1**.

Use information from **Figure 2**.

(1)

(e) The students repeated their investigation with two changes to the method:

- they used a pH meter to measure the pH
- they left the apparatus set up for 6 days instead of for 3 days.

Suggest a reason why each of these changes improves the investigation.

Using a pH meter

Leaving the apparatus set up for 6 days

(2)

Table 2 shows the results of the students' second investigation.

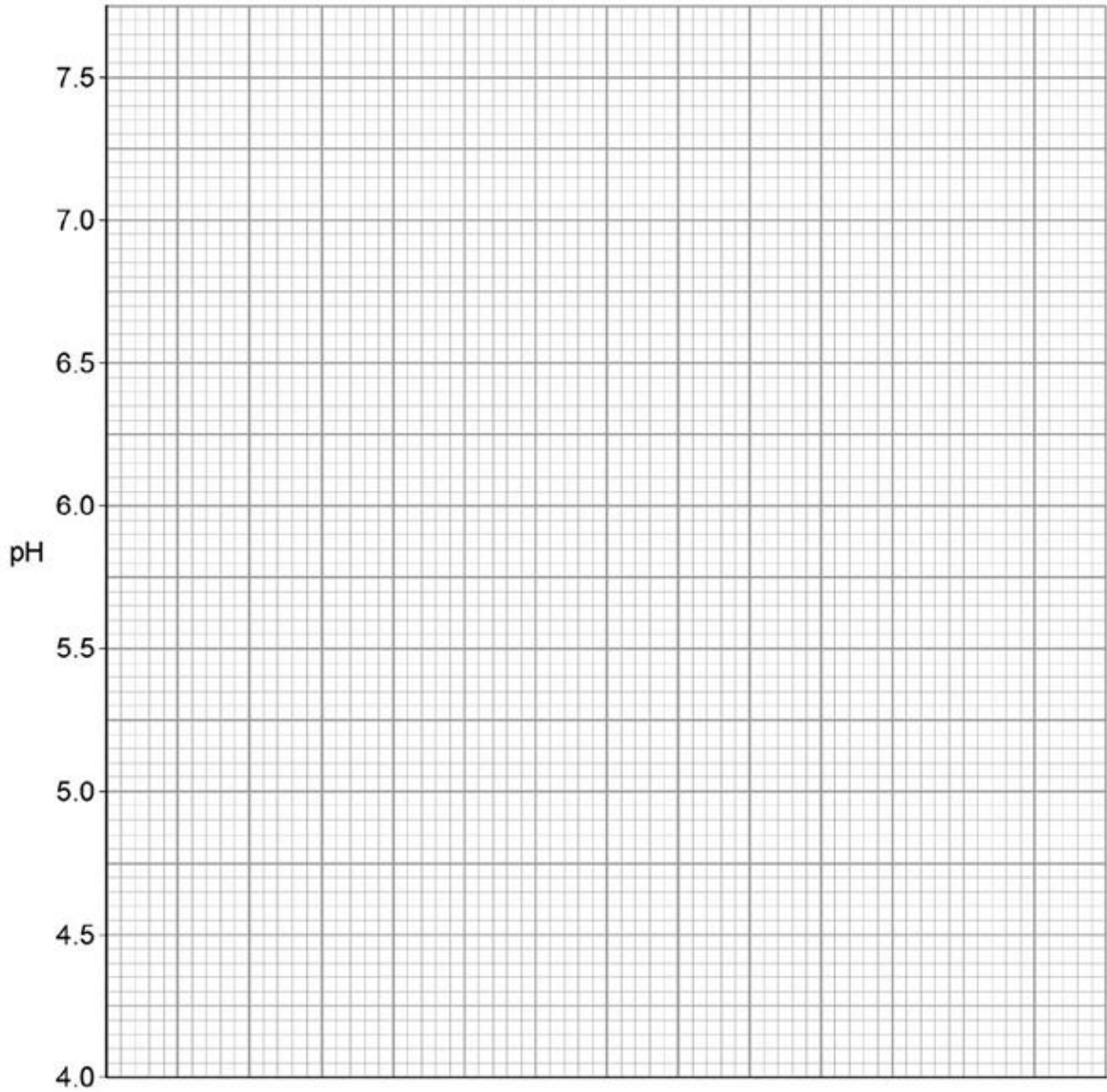
Table 2

Time in days	pH
0	7.0
1	7.0
2	6.7
3	6.0
4	5.0
5	4.5
6	4.5

(f) Complete the graph below.

You should:

- label the x-axis
- plot the data from **Table 2**
- draw a line of best fit.



(4)

(g) Give **one** reason for each of the following.

Use information from **Table 2** and the graph above.

The pH did not change during the first day:

The pH decreased after day 1:

There was no change in pH between days 5 and 6:

(3)

(h) The students did both of their investigations at 20 °C

The students then repeated the investigation with the pH meter, but at 25 °C

Predict how the new results would be:

- similar to the results at 20 °C
- different from the results at 20 °C

Similarity

Difference

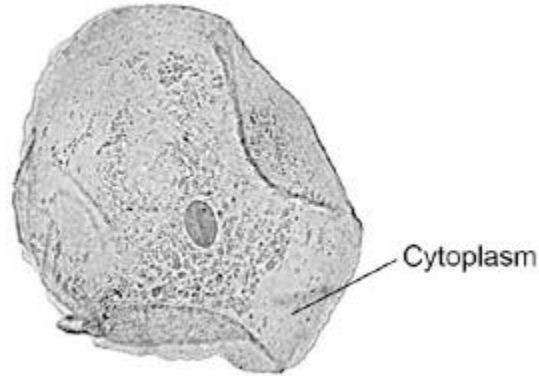
(2)

(Total 16 marks)

Q9.

Figure 1 shows a human cheek cell viewed under a light microscope.

Figure 1



© Ed Reschke/Photolibrary/Getty Images

(a) Label the nucleus **and** cell membrane on **Figure 1**. (2)

(b) Cheek cells are a type of body cell.

Body cells grow through cell division.

What is the name of this type of cell division?

Tick **one** box.

Differentiation

Mitosis

Specialisation

(1)

(c) Ribosomes and mitochondria are **not** shown in **Figure 1**.

What type of microscope is needed to see ribosomes and mitochondria?

(1)

(d) What is the advantage of using the type of microscope you named in part (c)?

Tick **one** box.

Cheaper

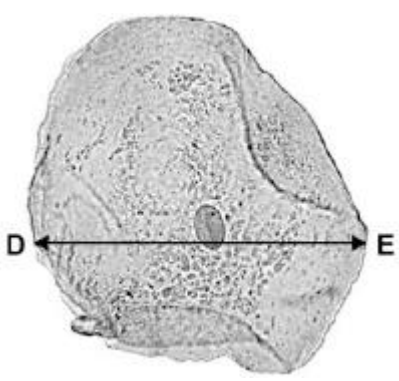
Higher magnification

Lower resolution

(1)

(e) The cheek cell in **Figure 2** is magnified 250 times.
 The width of the cell is shown by the line **D** to **E**.

Figure 2



Calculate the width of the cheek cell in micrometres (μm).

Complete the following steps.

Measure the width of the cell using a ruler _____ mm

Use the equation to work out the real width of the cell in mm:

$$\text{real size} = \frac{\text{image size}}{\text{magnification}} \quad \text{_____ mm}$$

Convert mm to μm _____ μm

(3)

(f) A red blood cell is $8 \mu\text{m}$ in diameter.
 A bacterial cell is 40 times smaller.
 Calculate the diameter of the bacterial cell.

Tick **one** box.

$0.02 \mu\text{m}$

0.2 μm

2.0 μm

20.0 μm

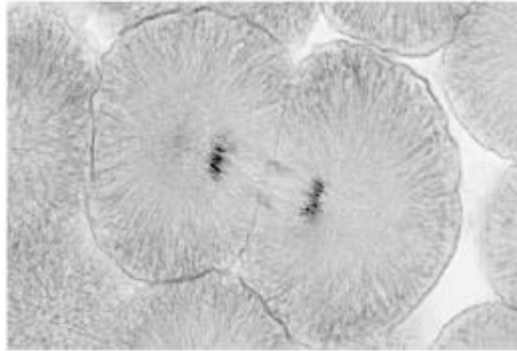
(1)
(Total 9 marks)

Q10.

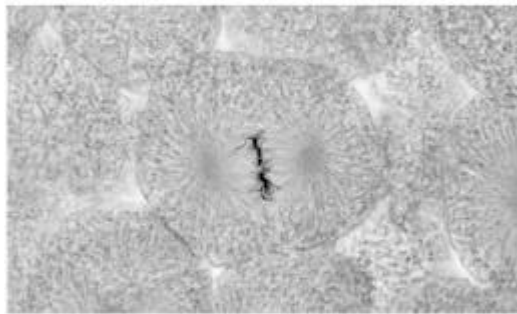
Figure 1 shows photographs of some animal cells at different stages during the cell cycle.

Figure 1

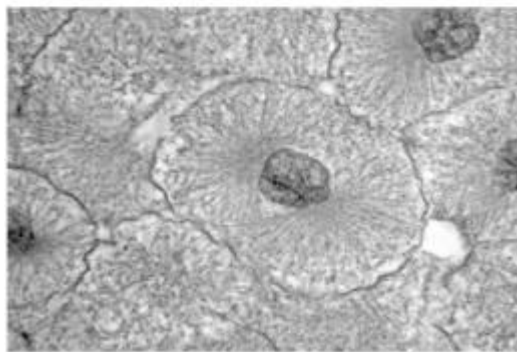
A



B



C



A © Ed Reschke/Photolibrary/Getty Images
B © Ed Reschke/Oxford Scientific/Getty Images
C © Ed Reschke/Photolibrary/Getty Images

- (a) Which photograph in **Figure 1** shows a cell that is **not** going through mitosis?

Tick **one** box.

A B C

(1)

- (b) Describe what is happening in photograph **A**.

(2)

- (c) A student wanted to find out more about the cell cycle.

The student made a slide of an onion root tip.

She counted the number of cells in each stage of the cell cycle in one field of view.

The table below shows the results.

	Stages in the cell cycle					Total
	Non-dividing cells	Stage 1	Stage 2	Stage 3	Stage 4	
Number of cells	20	9	4	2	1	36

Each stage of the cell cycle takes a different amount of time.

Which stage is the fastest in the cell cycle?

Give a reason for your answer.

Stage _____

Reason

(2)

- (d) The cell cycle in an onion root tip cell takes 16 hours.

Calculate the length of time **Stage 2** lasts in a typical cell.

Give your answer to 2 significant figures.

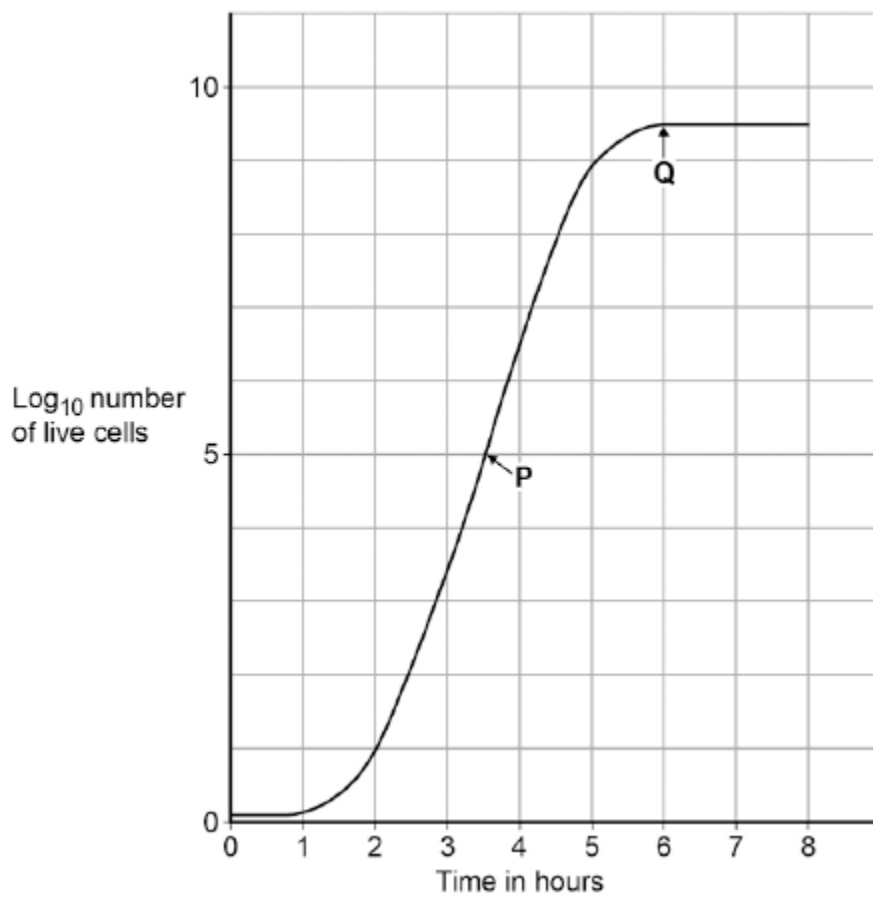
Time in **Stage 2** = _____ minutes

(3)

- (e) Bacteria such as *Escherichia coli* undergo cell division similar to mitosis.

Figure 2 shows a growth curve for *E. coli* grown in a nutrient broth.

Figure 2



What type of cell division causes the change in number of *E. coli* cells at **P**?

(1)

(f) Suggest why the number of cells levels out at **Q**.

(2)

(Total 11 marks)

Q11.

Explain how the human circulatory system is adapted to:

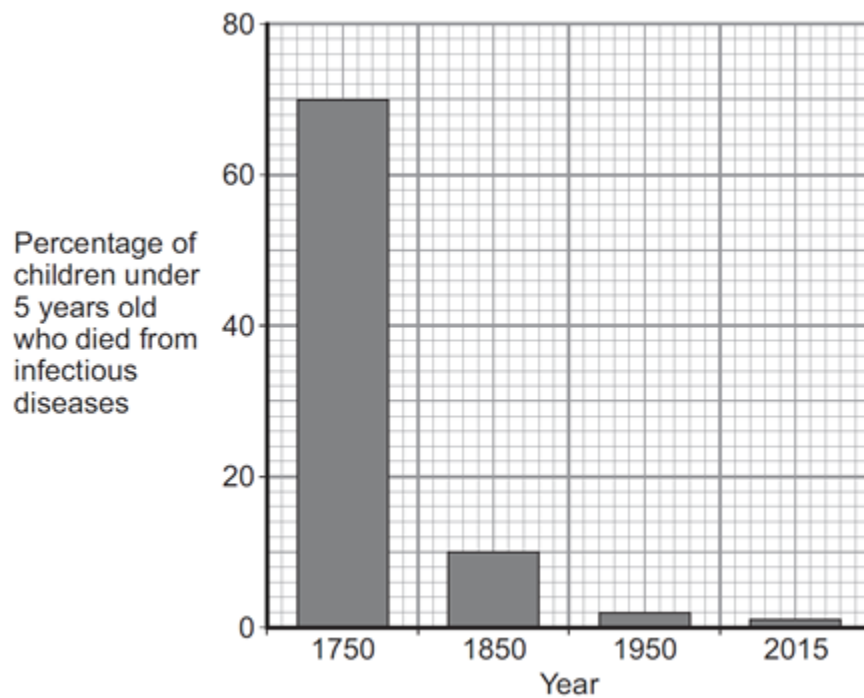
- supply oxygen to the tissues
- remove waste products from tissues.

(Total 6 marks)

Q12.

Pathogens are microorganisms that cause infectious diseases.

- (a) The graph shows the percentage of children under 5 years old who died from infectious diseases, in the UK, in four different years.



- (i) Between 1750 and 1850 vaccinations were also developed. What is in a vaccine?

Tick (✓) **one** box.

large amounts of dead pathogens

large amounts of live pathogens

small amounts of dead pathogens

(1)

(ii) The advances in medicine had an effect on death rate.

Describe the effect these advances had between 1750 and 1850.

To gain full marks you should include data from the graph above.

(2)

(b) Antibiotics were developed in the 1940s. Antibiotics kill bacteria.

(i) Which **one** of the following is an antibiotic?

Draw a ring around the correct answer.

cholesterol

penicillin

thalidomide

(1)

(ii) The use of antibiotics has **not** reduced the death rate due to all diseases to zero.

Suggest **two** reasons why.

1.

2.

(2)

- (c) In school laboratories, bacteria should be grown at a maximum temperature of 25 °C.

Give **one** reason why companies testing new antibiotics grow bacteria at 37 °C.

(1)

(Total 7 marks)

Q13.

Living organisms are made of cells.

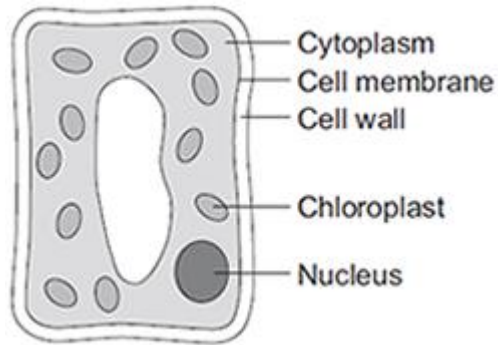
- (a) Animal and plant cells have several parts. Each part has a different function.

Draw **one** line from each cell part to the correct function of that part.

Cell part	Function
Cell membrane	Where most energy is released in respiration
Mitochondria	Controls the movement of substances into and out of the cell
Nucleus	Controls the activities of the cell
	Where proteins are made

(3)

(b) The diagram below shows a cell from a plant leaf.



Which **two** parts in the diagram above are **not** found in an animal cell?

1.

2.

(2)

(Total 5 marks)

Q14.

Enzymes are made and used in all living organisms.

(a) What is an enzyme?

(2)

(b) Many enzymes work inside cells.

In which part of a cell will most enzymes work?

Draw a ring around the correct answer.

cell membrane

cytoplasm

nucleus

(1)

(c) We can also use enzymes in industry.

Hydrogen peroxide is a chemical that can be used to preserve milk.

Adding a small amount of hydrogen peroxide to the milk kills the bacteria that cause decay. Hydrogen peroxide does not kill all disease-causing bacteria.

The enzyme catalase can be added later to break down the hydrogen peroxide to oxygen and water.

A different way of preserving the milk is by heating it in large machines to 138 °C for a few seconds.

Suggest **one** advantage and **one** disadvantage of using hydrogen peroxide and catalase to preserve milk instead of using heat treatment.

Advantage of hydrogen peroxide and catalase

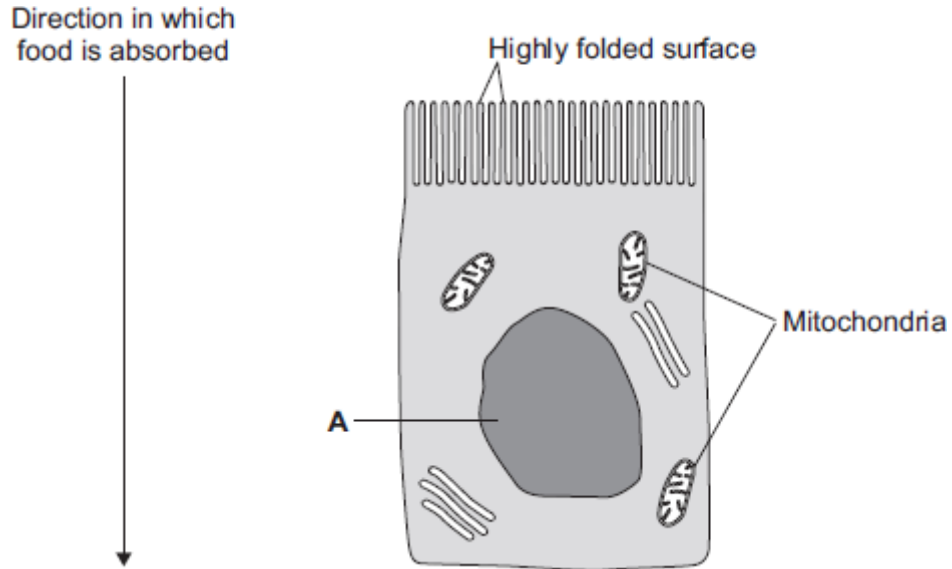
Disadvantage of hydrogen peroxide and catalase

(2)

(Total 5 marks)

Q15.

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.

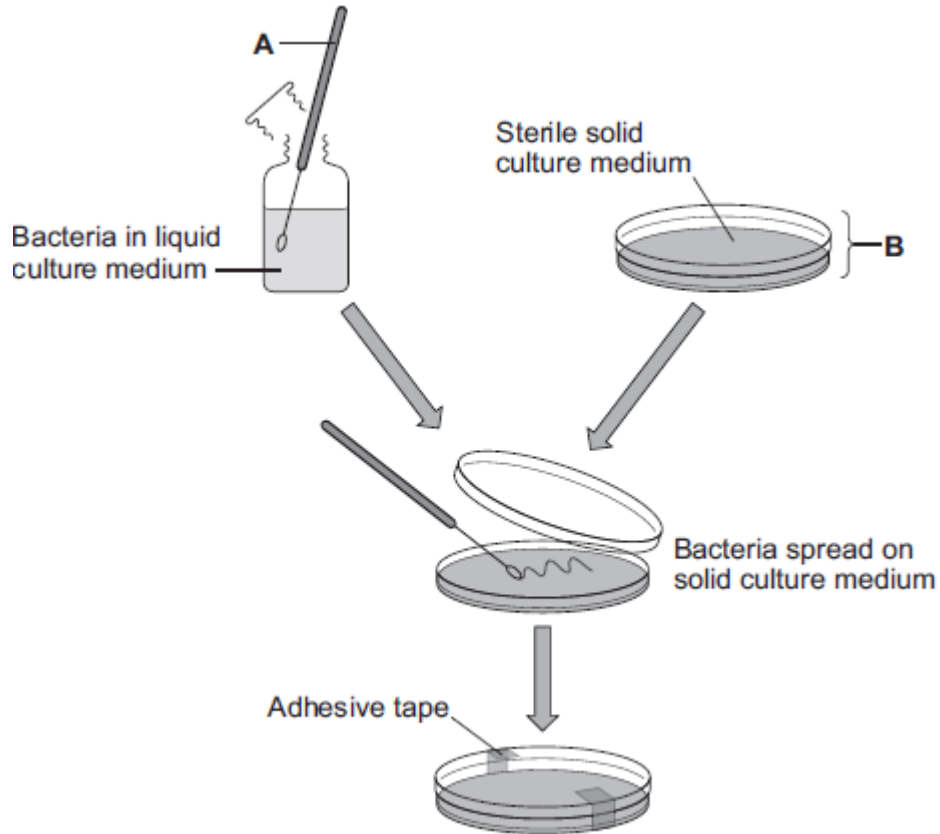
Give **one** substance that plants absorb by active transport.

(1)

(Total 8 marks)

Q16.

The diagram shows a method used to grow pure cultures of a bacterium.



(a) Name apparatus **A** and apparatus **B**.

Apparatus **A** _____

Apparatus **B** _____

(2)

(b) (i) Why should apparatus **A** and apparatus **B** be sterilised before they are used?

(1)

(ii) How should apparatus **A** be sterilised?

Tick (✓) **one** box.

Using enzymes

Using a flame

In an incubator

(1)

(iii) Adhesive tape is used to secure the lid on apparatus **B**.

Give **one** reason why the lid of apparatus **B** should be securely taped in place.

(1)

(c) What is the maximum temperature that should be used **in schools** to grow the bacteria in apparatus **B**?

Draw a ring around the correct answer.

10 °C

25 °C

50 °C

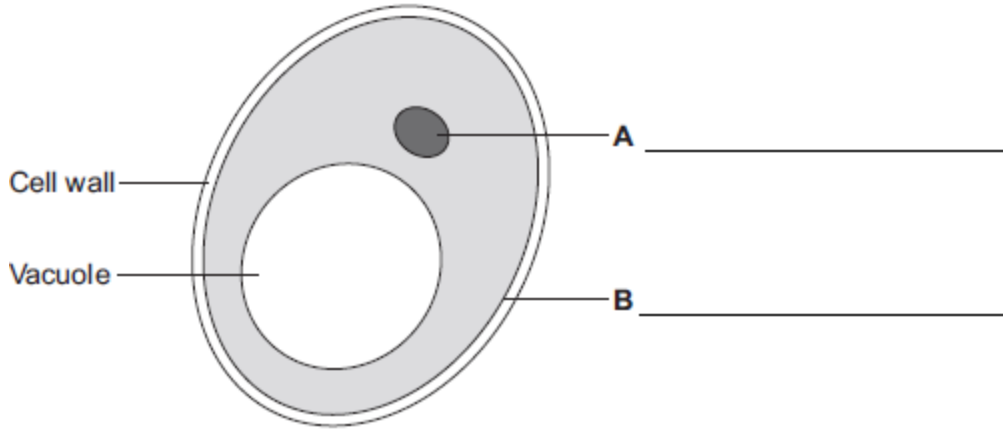
(1)

(Total 6 marks)

Q17.

Human cells and yeast cells have some parts that are the same.

(a) The diagram shows a yeast cell.



Parts **A** and **B** are found in human cells and in yeast cells. On the diagram, label parts **A** and **B**.

(2)

(b) Many types of cell can divide to form new cells.

Some cells in human skin can divide to make new skin cells.

Why do human skin cells need to divide?

(1)

(c) Human stem cells can develop into many different types of human cell.

(i) Use the correct answer from the box to complete the sentence.

embryos	hair	nerve cells
----------------	-------------	--------------------

Human stem cells may come from

(1)

(ii) Use the correct answer from the box to complete the sentence.

cystic fibrosis	paralysis	polydactyly
------------------------	------------------	--------------------

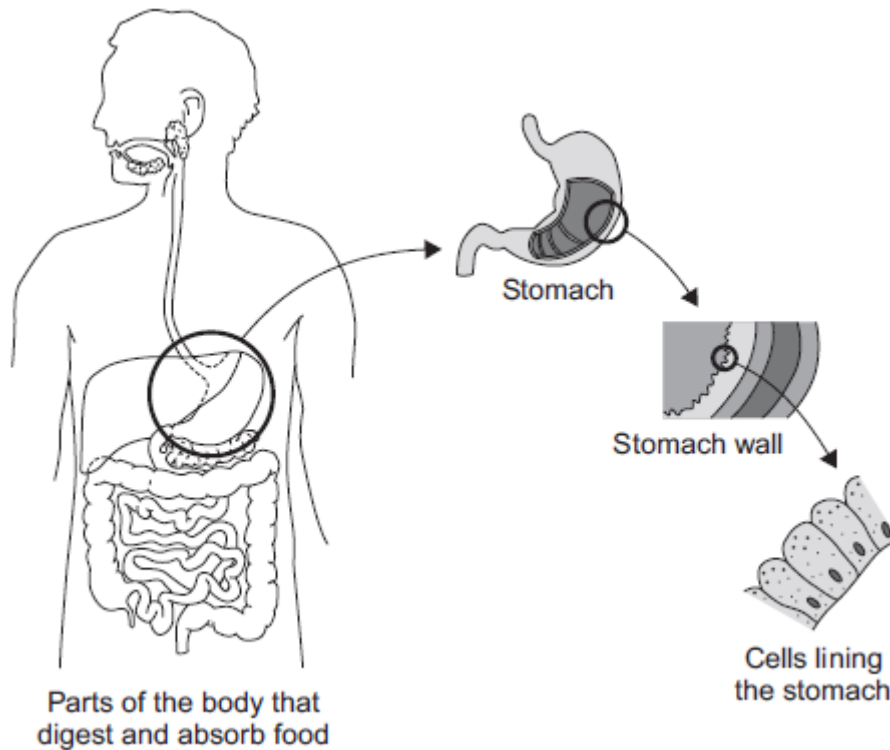
Human stem cells can be used to treat

(1)
(Total 5 marks)

Q18.

The diagram below shows the parts of the body that digest and absorb food.

It also shows some details about the structure of the stomach.



- (a) Complete the table to show whether each structure is an organ, an organ system or a tissue.

For each structure, tick (✓) **one** box.

Structure	Organ	Organ system	Tissue
Stomach			
Cells lining the stomach			
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine			

(2)

- (b) (i) The blood going to the stomach has a high concentration of oxygen. The cells lining the stomach have a low concentration of oxygen.

Complete the following sentence.

Oxygen moves from the blood to the cells lining the stomach by the process of _____ .

(1)

- (ii) What other substance must move from the blood to the cells lining the stomach so that respiration can take place?

Draw a ring around the correct answer.

glucose **protein** **starch**

(1)

- (iii) In which part of a cell does aerobic respiration take place?

Draw a ring around the correct answer.

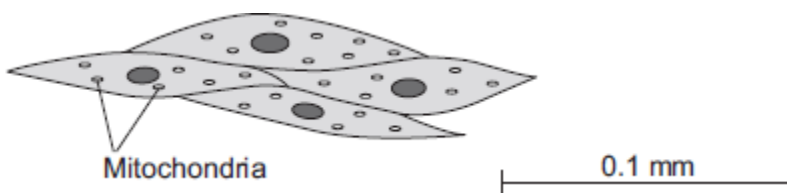
cell membrane **mitochondria** **nucleus**

(1)

(Total 5 marks)

Q19.

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)

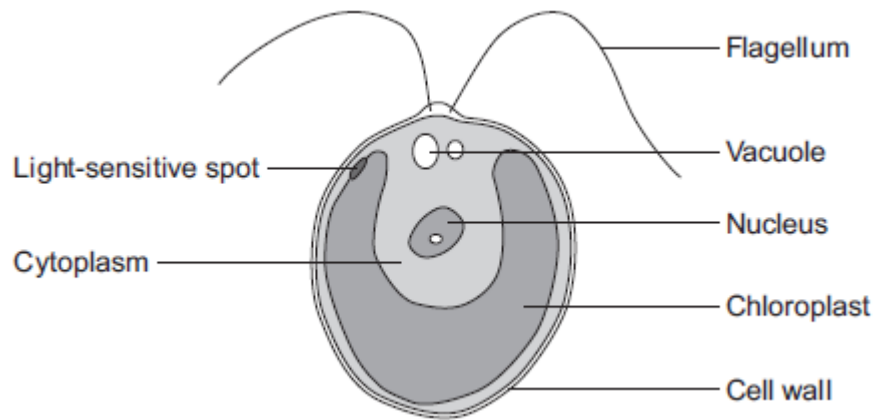
(ii) Suggest why the ribosomes **cannot** be seen through a light microscope.

(1)

(Total 8 marks)

Q20.

The diagram below shows a single-celled alga which lives in fresh water.



(a) Which part of the cell labelled above:

(i) traps light for photosynthesis

(1)

(ii) is made of cellulose?

(1)

(b) In the freshwater environment water enters the algal cell.

(i) What is the name of the process by which water moves into cells?

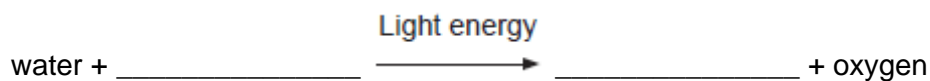
(1)

- (ii) Give the reason why the algal cell does not burst.

(1)

- (c) (i) The alga can photosynthesise.

Complete the **word** equation for photosynthesis.



(2)

- (ii) The flagellum helps the cell to move through water. Scientists think that the flagellum and the light-sensitive spot work together to increase photosynthesis.

Suggest how this might happen.

(2)

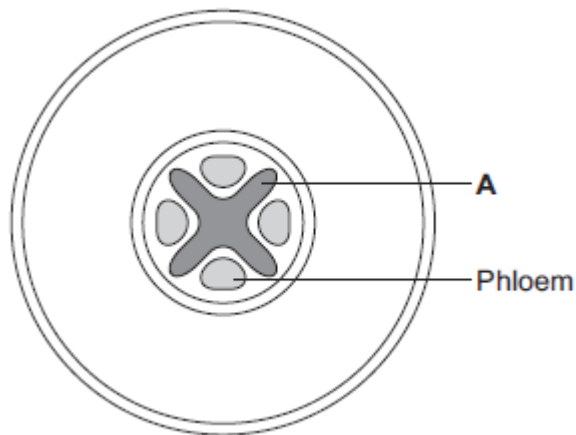
- (d) Multicellular organisms often have complex structures, such as lungs, for gas exchange.

Explain why single-celled organisms, like algae, do **not** need complex structures for gas exchange.

(3)
(Total 11 marks)

Q21.

The diagram below shows a cross-section of a plant root. The transport tissues are labelled.



(a) (i) What is tissue **A**?

Draw a ring around the correct answer.

cuticle epidermis xylem

(1)

(ii) Name **two** substances transported by tissue **A**.

1.

—

2.

—

(2)

(b) Phloem is involved in a process called translocation.

(i) What is translocation?

(1)

(ii) Explain why translocation is important to plants.

(2)

(c) Plants must use active transport to move some substances from the soil into root hair cells.

(i) Active transport needs energy.

Which part of the cell releases most of this energy?

Tick (✓) **one** box.

mitochondria

nucleus

ribosome

(1)

(ii) Explain why active transport is necessary in root hair cells.

(2)
(Total 9 marks)

Q22.

Some infections are caused by bacteria.

- (a) The genetic material is arranged differently in the cells of bacteria compared with animal and plant cells.

Describe **two** differences.

(2)

- (b) Tuberculosis (TB) is an infection caused by bacteria.

The table below shows the number of cases of TB in different regions of southern England from 2000–2011.

Number of cases of TB per 100 000 people

Year	London	South	South
------	--------	-------	-------

		East	West
2000	37	5	3
2001	36	6	4
2002	42	6	6
2003	42	7	4
2004	42	7	5
2005	49	8	5
2006	44	8	3
2007	43	8	5
2008	44	8	5
2009	44	9	6
2010	42	9	5
2011	45	10	5

- (i) How does the number of cases of TB for London compare with the rest of southern England?

(1)

- (ii) Describe the pattern in the data for cases of TB in the South East.

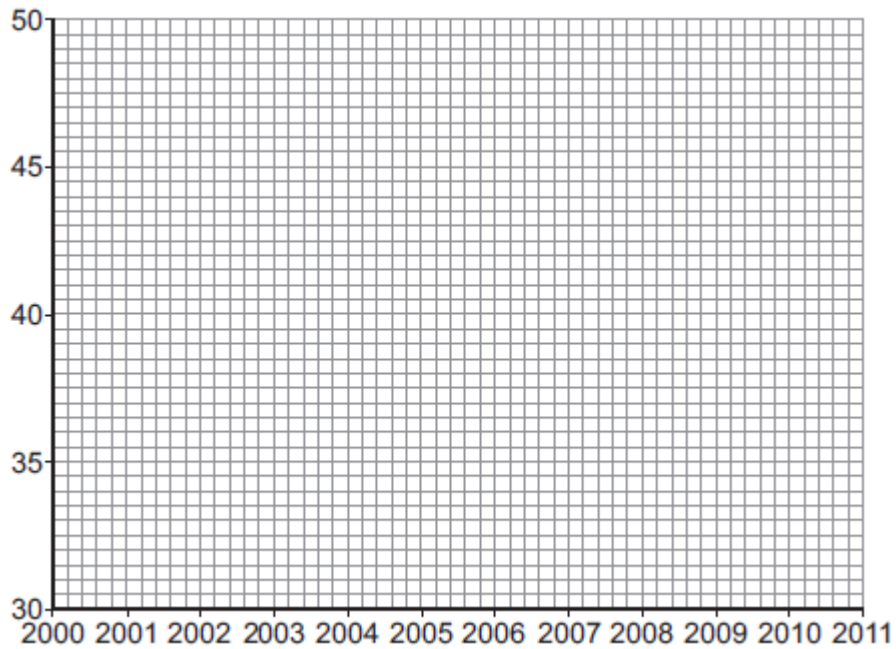
(1)

- (iii) Describe the pattern in the data for cases of TB in the South West.

(2)

(c) (i) On the graph paper below:

- plot the number of cases of TB in **London**
- label both the axes on the graph
- draw a line of best fit.



(4)

(ii) Suggest why a student thought the value for 2005 in London was anomalous.

(1)

(d) People can be vaccinated against TB.

Suggest how a vaccination programme would reduce the number of people with TB.

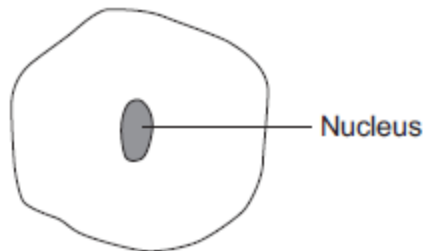
Details of how a vaccine works are **not** required.

(2)

(Total 13 marks)

Q23.

The diagram below shows a cell.



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

(i) In the nucleus of a cell, genes are part of

- chromosomes.
- membranes.
- receptors.

(1)

(ii) Different genes control different

- characteristics
- gametes
- nuclei

of an organism.

(1)

(iii) Studying the similarities and differences between organisms allows us to

classify clone grow

the organisms.

(1)

(b) Complete the following sentence.

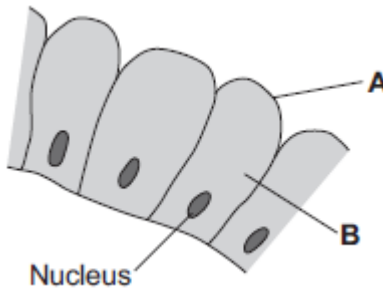
Living things can be grouped into animals, microorganisms and _____

(1)

(Total 4 marks)

Q24.

The image below shows some cells in the lining of the stomach.



(a) (i) Use words from the box to name structures **A** and **B**.

cell membrane	chloroplast	cytoplasm	vacuole
---------------	-------------	-----------	---------

A _____

B _____

(2)

(ii) What is the function of the nucleus?

Tick (✓) **one** box.

To control the activities of the cell

To control movement of substances into and out of the cell

To release energy in respiration

(1)

(b) Draw **one** line from each part of the human body to its correct scientific name.

Part of human body	Scientific name
Layer of cells lining the stomach	An organ
Stomach	An organism
Mouth, stomach, intestines, liver and pancreas	An organ system
	A tissue

(3)

(Total 6 marks)

Q25.

A student is given a tube containing a liquid nutrient medium. The medium contains one type of bacterium.

(a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The student is told to grow some of the bacteria on agar jelly in a Petri dish.

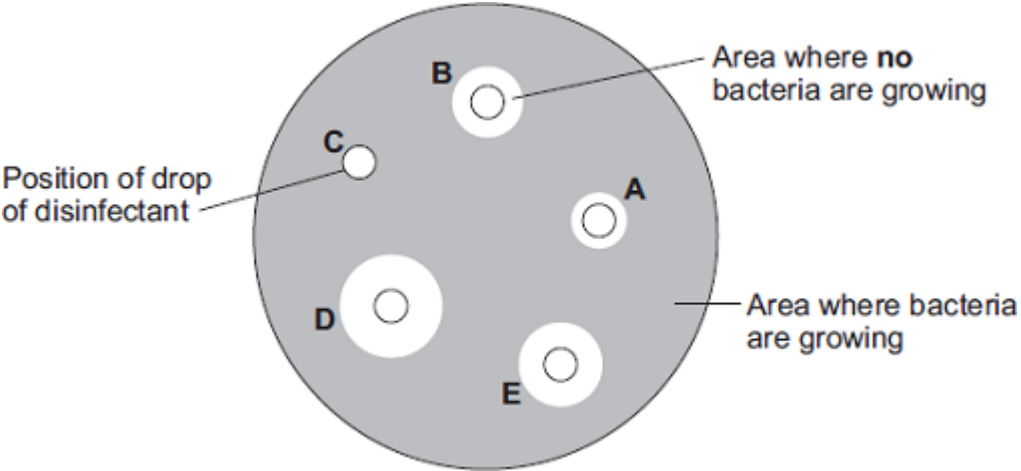
Describe how the student should prepare an uncontaminated culture of the bacterium in the Petri dish.

You should explain the reasons for each of the steps you describe.

(6)

- (b) After the culture had been prepared, the student added one drop of each of five disinfectants, **A**, **B**, **C**, **D** and **E**, onto the culture.

The diagram shows the appearance of the Petri dish 3 days later.



- (i) There are areas on the agar jelly where **no** bacteria are growing.

Why?

(1)

- (ii) The student concluded that disinfectant **D** would be the best for using around the home.

Give **one** reason why the student might be correct.

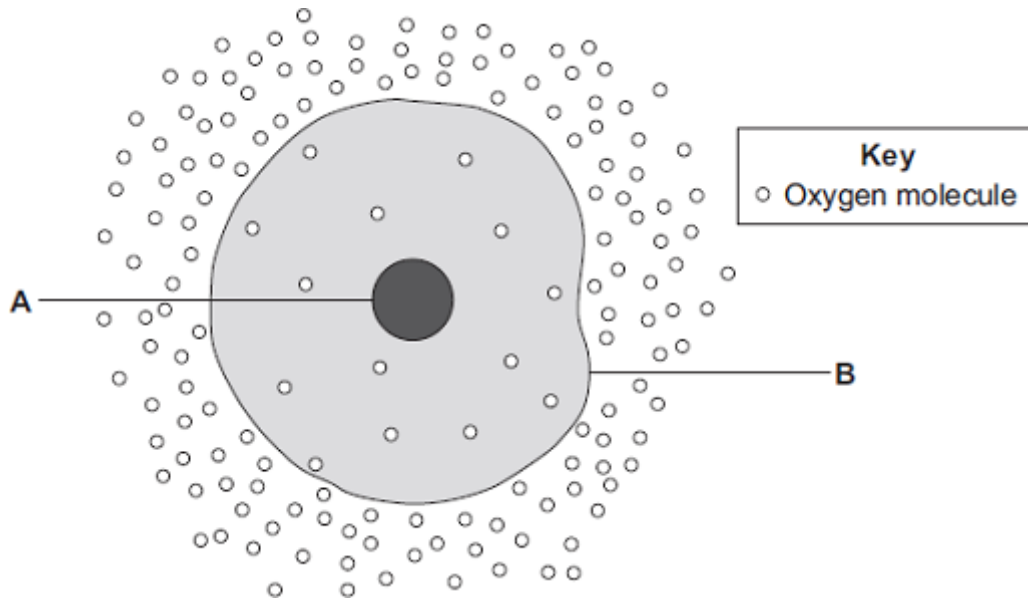
Give **one** reason why the student might **not** be correct.

(2)

(Total 9 marks)

Q26.

The diagram shows a cell.



(a) (i) Use words from the box to name the structures labelled **A** and **B** .

cell membrane	chloroplast	cytoplasm	nucleus
---------------	-------------	-----------	---------

A _____

B _____

(2)

(ii) The cell in the diagram is an animal cell.

How can you tell it is an animal cell and **not** a plant cell?

Give **two** reasons.

1.

2.

(2)

(b) Oxygen will diffuse into the cell in the diagram.

Why?

Use information from the diagram.

(1)

(c) The cell shown in the diagram is usually found with similar cells.

Draw a ring around the correct answer to complete the sentence.

Scientists call a group of similar cells

- | |
|-----------|
| an organ. |
| a system. |
| a tissue. |

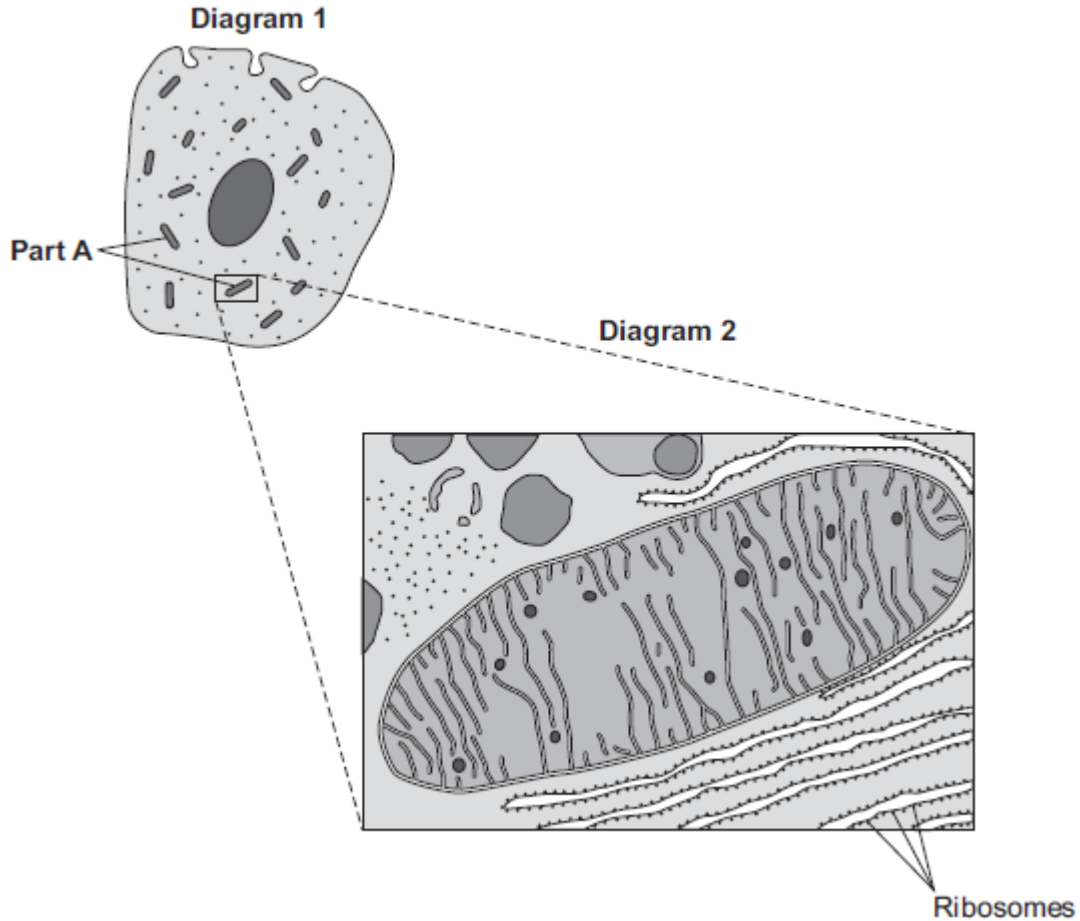
(1)

(Total 6 marks)

Q27.

Diagram 1 shows a cell from the pancreas.

Diagram 2 shows part of the cell seen under an electron microscope.

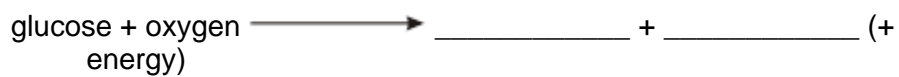


Part **A** is where most of the reactions of aerobic respiration happen.

- (a) (i) Name part **A**.

(1)

- (ii) Complete the equation for aerobic respiration.



(2)

- (iii) Part **A** uses oxygen.

Explain how oxygen passes from the blood to part **A**.

(3)

(b) The pancreas cell makes enzymes.

Enzymes are proteins.

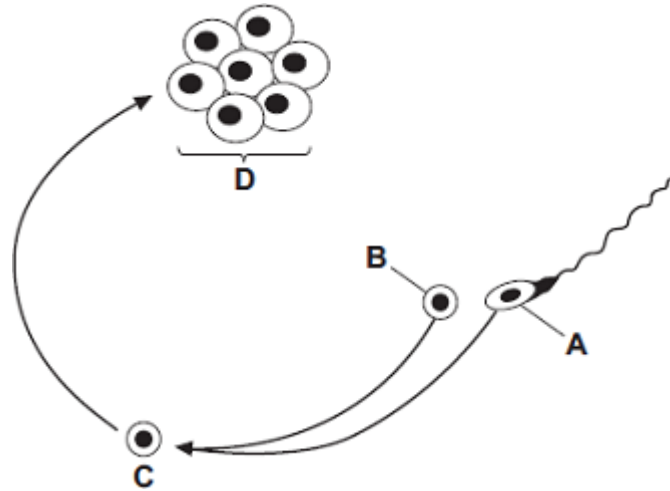
Describe how the ribosomes and part **A** help the cell to make enzymes.

(3)

(Total 9 marks)

Q28.

The diagram shows some of the stages in IVF (in vitro fertilisation).



(a) Use words from the box to name structures **A**, **B**, **C** and **D**.

egg	embryo	fertilised egg	ovary	sperm
-----	--------	----------------	-------	-------

Structure **A** _____

Structure **B** _____

Structure **C** _____

Structure **D** _____

(4)

(b) What do doctors do next with structure **D**?

(2)

(c) The table gives statistics for an IVF clinic.

	Age of women treated			
	Below 35 years	35 – 37 years	38 – 39 years	40 – 42 years
Number of women treated	414	207	106	53
Number of women who produced one baby	90	43	17	1
Number of women who produced twins	24	8	4	1
Number of women who produced triplets	1	0	0	0

- (i) About what proportion of the treated women aged 35 – 37 years produced one or more babies?

Draw a ring around your answer.

one quarter one third half

(1)

- (ii) This clinic does **not** give IVF treatment to women over 42 years of age.

Use data from the table to explain why.

(2)

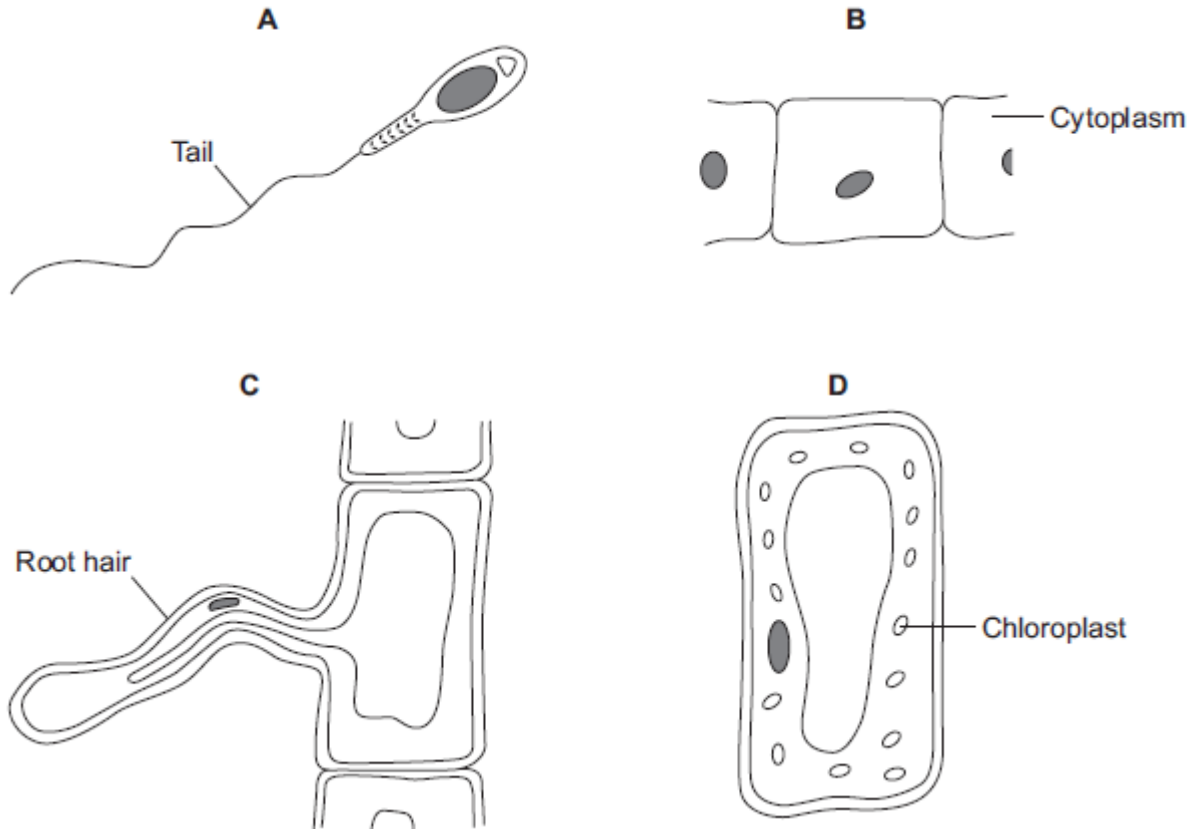
- (iii) The committee which regulates IVF treatment now advises that only one embryo is used in each treatment.

Suggest **one** reason for this.

(1)
(Total 10 marks)

Q29.

The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.



(a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

A and B

A and D

C and D

(1)

(ii) Give **one** reason for your answer.

(1)

(b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming?

(1)

(ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis?

(1)

(c) Cells **A**, **B**, **C** and **D** all use oxygen.

For what process do cells use oxygen?

Draw a ring around **one** answer.

osmosis

photosynthesis

respiration

(1)

(Total 5 marks)

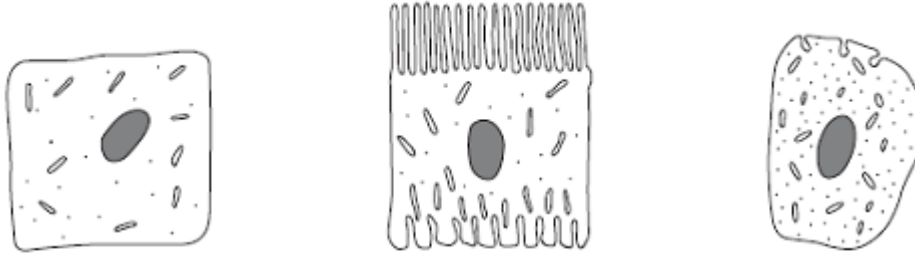
Q30.

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.

A

B

C



Key
- Mitochondrion
· Ribosome

(a) Which cell, **A**, **B** or **C**, appears to be best adapted to increase diffusion into or out of the cell?

Give **one** reason for your choice.

(1)

(b) (i) Cell **C** is found in the salivary glands.

Name the enzyme produced by the salivary glands.

(1)

(ii) Use information from the diagram to explain how cell **C** is adapted for producing this enzyme.

(2)

(Total 4 marks)

Q31.

- (a) Mr and Mrs Smith both have a history of cystic fibrosis in their families. Neither of them has cystic fibrosis. Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol **A** for the dominant allele and the symbol **a** for the recessive allele.

(3)

- (b) Mr and Mrs Smith decided to visit a genetic counsellor who discussed embryo screening.

Read the information which they received from the genetic counsellor.

- Five eggs will be removed from Mrs Smith's ovary while she is under an anaesthetic.
- The eggs will be fertilised in a dish using Mr Smith's sperm cells.
- The embryos will be grown in the dish until each embryo has about thirty cells.
- One cell will be removed from each embryo and tested for cystic fibrosis.
- A suitable embryo will be placed into Mrs Smith's uterus and she may become pregnant.



• Any unsuitable embryos will be destroyed.

- (i) Suggest why it is helpful to take five eggs from the ovary and not just one egg.

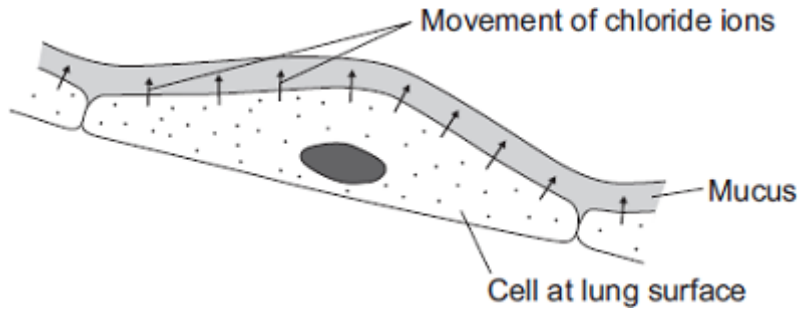
(1)

- (ii) Evaluate the use of embryo screening in this case.
Remember to give a conclusion to your evaluation.

(4)

- (c) In someone who has cystic fibrosis the person's mucus becomes thick.
The diagram shows how, in a healthy person, cells at the lung surface move

chloride ions into the mucus surrounding the air passages.



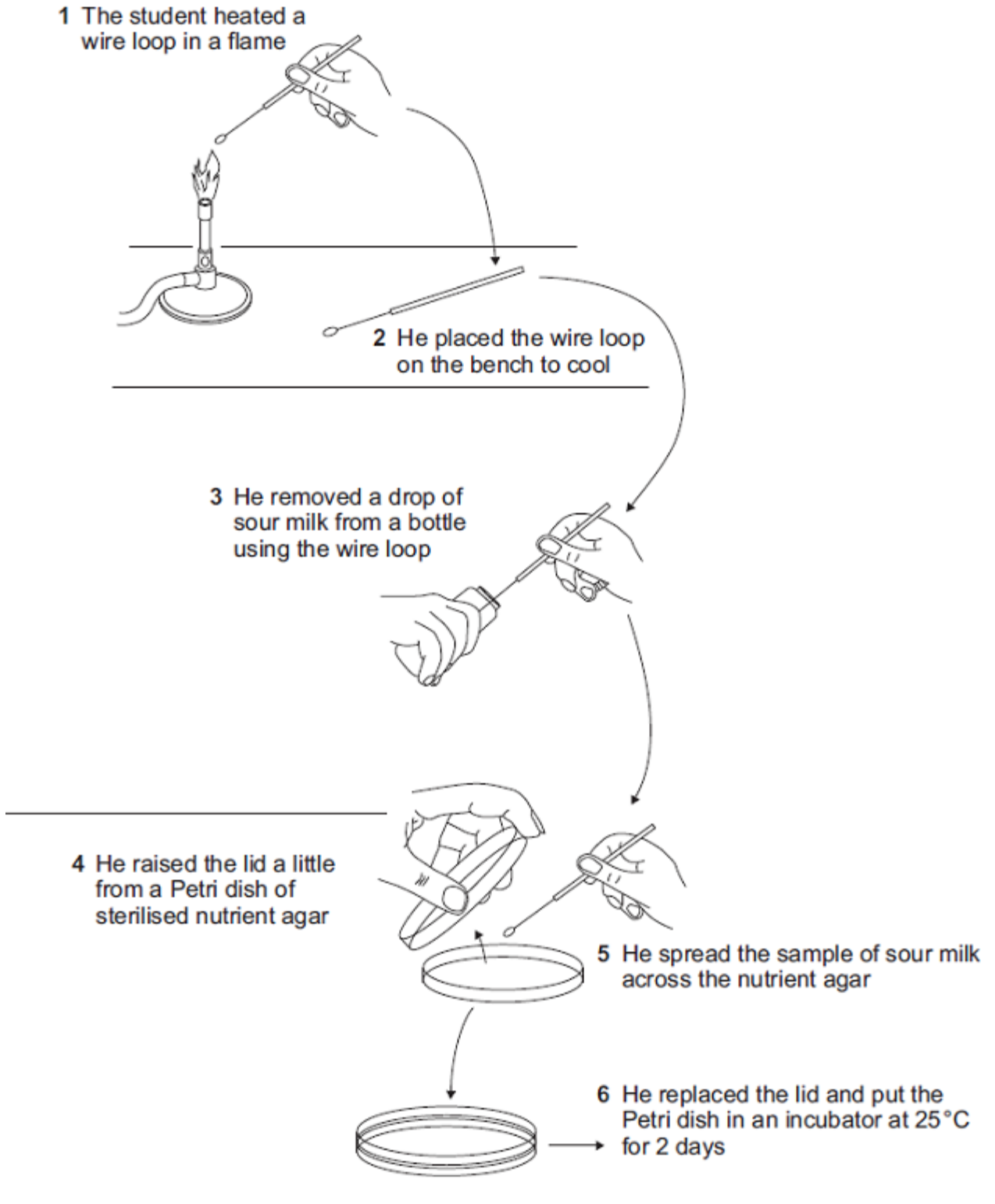
The movement of chloride ions causes water to pass out of the cells into the mucus.

Explain why.

(3)
(Total 11 marks)

Q32.

The diagram shows how a student transferred some sour milk from a bottle to a Petri dish of nutrient agar.



List A gives four actions carried out by the student.
List B gives five possible effects of these actions.

Draw a straight line from each action in **List A** to its effect in **List B**.
Draw only **one** line from each action.

List A – Action

List B – Effect

Heating loop in flame

Risk of contamination with bacteria increased

Placing loop on bench to cool

Fewer bacteria will enter

Only lifting lid of Petri dish a little

Kills bacteria

Placing Petri dish in incubator at 25°C

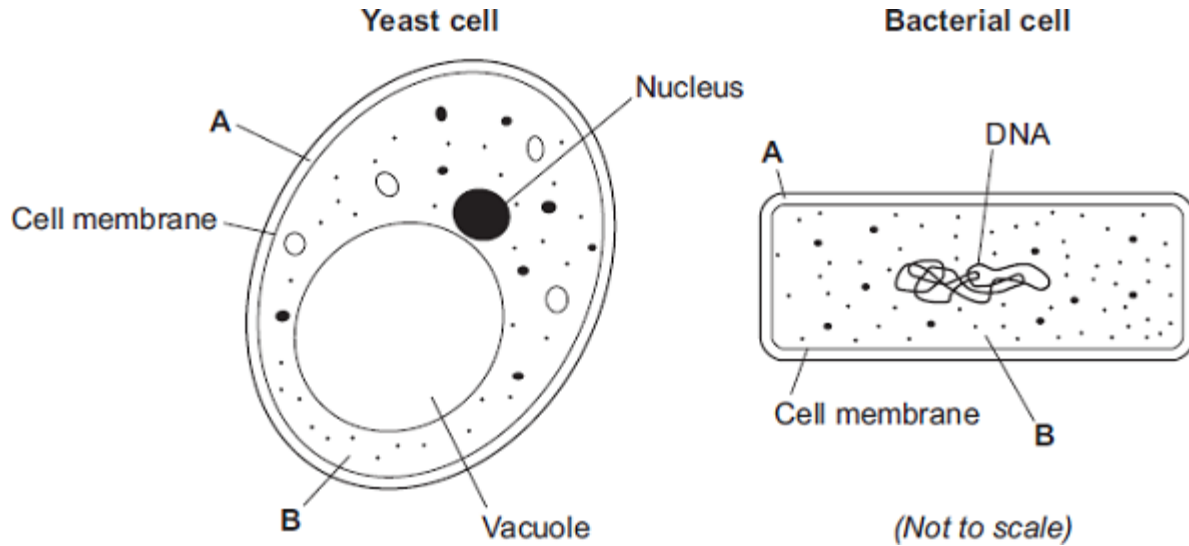
Prevents air entering

Risk of growth of pathogens decreased

(Total 4 marks)

Q33.

(a) The diagrams show the structures of a yeast cell and a bacterial cell.



- (i) Both the yeast cell and the bacterial cell have structures **A** and **B**.

Name structures **A** and **B**.

A _____

B _____

(2)

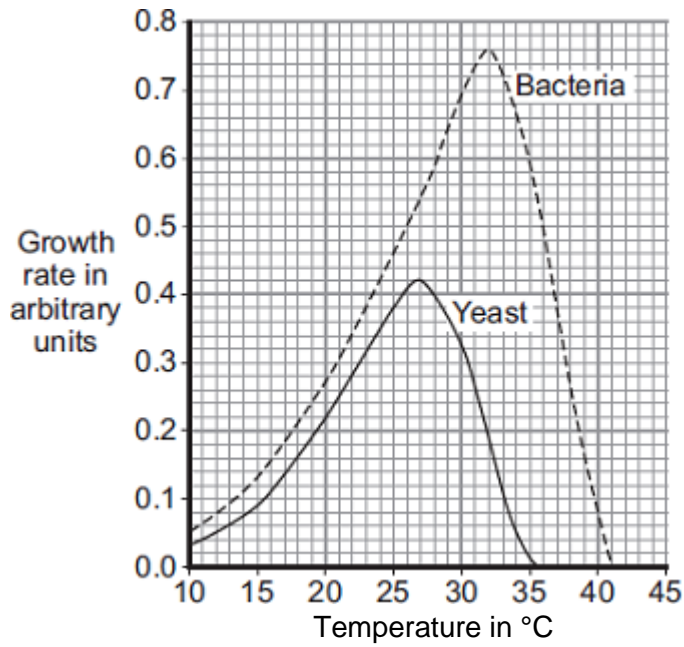
- (ii) The yeast cell and the bacterial cell have different shapes and sizes.

Give **one** other way in which the structure of the bacterial cell is different from the structure of the yeast cell.

(1)

- (b) Sourdough bread is light in texture and tastes slightly sour. The bread is made using two types of microorganism, a yeast and a bacterium. The bacterium can make acids such as lactic acid. The acid makes the bread taste sour.

The graph shows how the growth rates of the yeast and the bacteria change with temperature.



- (i) Sourdough bread rises fastest at 27°C.

Use information from the graph to explain why.

(2)

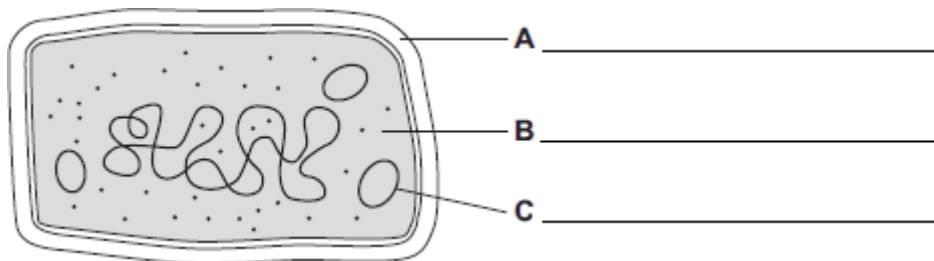
- (ii) The bread tastes most sour if it rises at 32°C.

Use information from the graph to explain why.

(2)
(Total 7 marks)

Q34.

(a) The diagram shows the structure of a bacterial cell.



(i) On the diagram use words from the box to label structures **A**, **B** and **C**.

cell membrane	cell wall	chloroplast	cytoplasm	plasmid
---------------	-----------	-------------	-----------	---------

(3)

(ii) Give **one** difference between the structure of the bacterial cell and an animal cell.

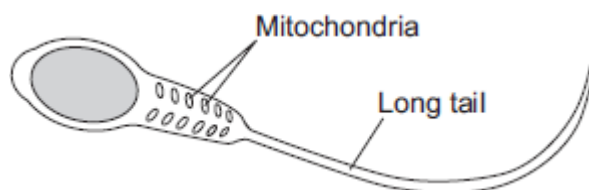
(1)

(iii) Name **one** structure that is found in a plant cell but is **not** found in a bacterial or an animal cell.

(1)

(b) Cells can be specialised for a particular job.

The diagram shows the structure of a human sperm cell.



Describe how the long tail and the mitochondria help the sperm to do its job.

Long tail

Mitochondria

(4)
(Total 9 marks)

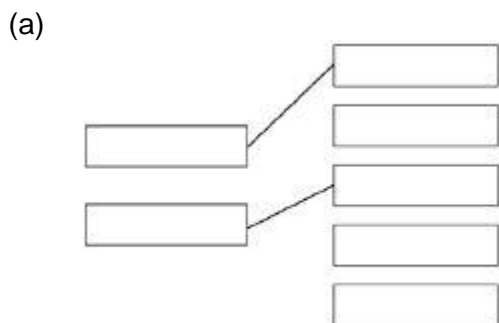
Mark schemes

Q1.

- (a) nucleus 1
- (b) gene(s) 1
allow allele(s)
- (c) copying of chromosomes 1
- (d) mitochondria 1
- (e) 60 – 45 1
or
 120 – 105
- 15 (minutes) 1
an answer of 15 (minutes) scores 2 marks
- (f) C 1
- (g) 8 1
- (h) to repair tissues 1

[9]

Q2.



*additional line from a level of organisation
negates the mark for that level of organisation*

- (b) palisade mesophyll 1

- (c) $\frac{50}{8}$ 1
- 6 / 6.25 / 6.3 (micrometres) 1
- an answer of 6 / 6.25 / 6.3 scores 2 marks*
- (d) they have no chloroplasts / chlorophyll
allow they are underground
allow they don't get (access to) light
allow (because) photosynthesis needs light
allow they can't absorb light
ignore 'sun'
ignore 'it is dark' 1
- (e) differentiation 1
- (f) to protect endangered plants from extinction 1
- (g) plants can be produced quickly 1
- (h) any **one** from:
 - glucose / sugars / starch
 - amino acids / protein
 - hormones
allow named hormones e.g. auxin
 - ions / minerals
allow magnesium / nitrate
 - vitamins
allow named vitamins e.g. vitamin B
 - water
allow H₂O / H₂O
ignore oxygen / carbon dioxide / agar / nutrients / fertiliser
 1
- [10]**

Q3.

- (a) toxins / poisons (secreted by / from / in bacteria) 1
- (b) any **two** from:
 - wash hands after using toilet / being sick
 - or**
 - wash hands before preparing / handling food
 - or**
 - do not prepare food (whilst infected)
ignore 'wash hands' unqualified
ignore reference to coughing / sneezing

- isolate yourself
allow examples of how isolation could be achieved
 - disinfect clothes / surfaces
 - do not share utensils / cutlery / towels
- 2
- (c) antibiotics
allow named examples of antibiotics
- 1
- (d) immune system is damaged / weakened **or** immune system doesn't function properly
allow immunocompromised
allow lack of / no white blood cells
- 1
- white blood cells cannot kill bacteria / *Salmonella* (as effectively)
allow no / fewer antibodies so bacteria not killed
***or** less phagocytosis so bacteria not killed **or** no / fewer antitoxins to counter toxins*
- 1
- (e) any **one** from:
- (give chickens) antibiotics
allow (give chickens) monoclonal antibodies
 - don't sell infected chickens / eggs
allow don't sell the chickens / eggs
ignore don't sell chickens / eggs
 - keep infected chickens isolated / indoors
allow keep the chickens indoors
ignore keep chickens indoors
 - slaughter the infected chickens
ignore vaccination / chlorination / disinfection
- 1
- (f) (cleaning liquid) B
and
greater reduction in number of bacteria (after cleaning) in both locations
ignore few bacteria in both locations
*allow neither / both **and** idea of experimental error*
- 1
- (g) radius (of area with no bacteria growing)
allow diameter (of the area with no bacteria growing)
ignore πr^2 unqualified
allow idea of placing agar plate onto graph paper

and counting the squares not covered with bacteria

1

- (h) repeat **and** look to see if results are similar
ignore repeat unqualified
*allow repeat **and** look to see if results are different*
allow repeat and see if there are anomalies
ignore repeat and identify anomalies
ignore repeat and compare unqualified

1

- (i) any **one** from:
- toxicity / side / health effects
ignore harmful / dangerous
allow reference to allergies
 - effect on other types of bacteria / pathogens
allow not tested on other types of bacteria
ignore germs
 - interaction with other cleaners
 - ease of use
 - dilution factor of each cleaner (vs. cost)
ignore concentration unqualified
 - time cleaner is effective for
ignore how long the cleaner lasts for
allow reference to odour of cleaning liquid
ignore reference to cost unqualified
ignore environmental effects / flammability

1

[11]

Q4.

- (a) kills microorganisms / bacteria / fungi / viruses / microbes
allow to remove microorganisms / bacteria / fungi / viruses / microbes
ignore germs
allow so mycoprotein is not contaminated

1

(which) compete for food / oxygen

or

which make toxins

allow so mycoprotein is safe to eat

or

which are pathogens

or

which might kill the fungus / *Fusarium*

- 1
- (b) 30 °C 1
- (c) for (aerobic) respiration 1
*do **not** accept anaerobic*
- (which) releases energy (for growth) 1
*do **not** accept produces energy*
allow glucose is used to make other organic substances e.g. protein
- (d) any **two** from: 1
- so *Fusarium* can
- grow faster / better
 - get sufficient food / glucose / minerals
allow more / enough
 - get sufficient oxygen
allow more / enough
 - get rid of sufficient carbon dioxide
allow more / enough
allow waste
 - be kept at a (suitable) temperature
allow to avoid 'clumping'
- 2
- (e) 200 grams 1

[8]

Q5.

(a)

×	✓	✓
✓	×	✓

1 mark for each correct row if no other marks awarded allow a mark for one correct column

- 2
- (b) a bacterial cell 1
- (c) make / synthesise / produce protein 1
allow produce enzymes

- (d) 0.0015 (mm)
allow 1.5×10^{-3} (mm) 1
- (e) mitochondria are longer / bigger (than the cell)
allow too big 1
- (f)
 2^4
an answer of 16 scores 2 marks
allow $2 \times 2 \times 2 \times 2$ or a correct list showing doubling at each time interval 1
- 16
allow 90 mins = 8 for 1 mark 1
- (g) (number of live cells / bacteria) stays level / the same until 11 hours
answer must refer to number of live cells / bacteria (not the shape of the graph)
allow (number of cells / bacteria) is very low until 11 hours
allow number in the range 10-11 hours 1
- then (number of live cells / bacteria) increases rapidly to 2.5×10^8
or
 from 11 hours to 14.5 hours
allow (then) increases exponentially 1
- then (number of live cells / bacteria) stays at 2.5×10^8
allow (number of live cells / bacteria) stays the same for the next 5 hours
or
 stays the same from 15 to 20.5 hours
if no other mark awarded allow for 1 mark the idea that the graph is level, then increases, then levels off again 1
- (h) any **one** from:
- lack of food / nutrients / oxygen / space
or
 competition for space
 - build-up of toxins
allow ethanol
 - temperature too high
- 1

[12]

Q6.

- (a) electron (microscope) 1
- (b) $\frac{30000}{200}$
an answer of 150 (μm) scores 2 marks 1
- 150 (μm)
if answer is incorrect allow for 1 mark sight of 0.015 / 0.15 / 1.5 / 15
allow ecf for incorrect measurement of line X for max 1 mark 1
- (c) **either**
 large surface area
allow (vacuole contains) cell sap that is more concentrated than soil water (1) 1
- for more / faster osmosis
create / maintain concentration / water potential gradient (1)
- or**
- allow thin (cell) walls
- for short(er) diffusion distance 1
- (d) (on hot day) more water lost
allow converse for a cold day if clearly indicated 1
- more transpiration
or
 more evaporation 1
- so more water taken up (by roots) to replace (water) loss (from leaves) 1
- (e) (aerobic) respiration occurs in mitochondria
*do **not** accept anaerobic respiration* 1
- (mitochondria / respiration) release energy
*do **not** accept energy produced / made / created* 1
- (energy used for) active transport 1
- to transport ions, against the concentration gradient
or
 from a low concentration to a high concentration

Q7.

(a) 86

allow this answer only

*do **not** accept 85.7*

if no answer given, check for answer in the table

1

(b) as salt concentration increases, percentage of open stomata (in field of view) decreases (above 0.1 mol / dm³)

or

allow percentage of open stomata stays the same between 0.0 and 0.1 (mol / dm³) then decreases as salt concentration increases)

ignore references to number of open stomata

allow converse

allow idea that mean concentration (of salt) in guard cells is between 0.3 and 0.4 mol per dm³

1

(c) use concentrations between 0.3 (mol / dm³) and 0.4 (mol / dm³)

or

draw a graph of the data and read off the value at 50% (open stomata)

allow a list of appropriate concentrations i.e. 0.32 mol / dm³, 0.34 (mol / dm³), 0.36 (mol / dm³) etc.

1

(d) $(\pi \times 0.1875^2) = 0.11$ (mm²)

*an answer of 36 scores **3** marks*

1

$$\frac{4}{0.11}$$

1

36 (per mm²)

*allow 36.22 / 36.23 **or** 36.2*

*if answer is incorrect allow for **2** marks for sight of number of open stomata = 9 per mm² (diameter used instead of radius)*

*if no other marks awarded allow for **1** mark any **one** from:*

- *sight of area = 0.44(mm²) (diameter used instead of radius)*
- *sight of number of open stomata = 9.1 / 9.05 / 9.06 per mm² (diameter used instead of radius and no rounding)*

1

(e) (potassium) ions increase the concentration of the solution (inside guard cells)

or

(potassium) ions make cell more concentrated / less dilute

allow (potassium) ions decrease concentration of water / water potential (of guard cells)

- 1
- water moves into the (guard) cell by osmosis
- 1
- cell swells unevenly (so stoma opens)
- 1
- as inner wall is less flexible than outer wall **or** thick part of the wall is less flexible than the thin part (of the wall)
- 1

[10]

Q8.

- (a) to kill microorganisms on / in the flask
or
 so only microorganisms in the milk caused the results
allow bacteria / fungi / microbes
*do **not** accept viruses*
ignore germs
- 1

- (b) heating
- 1
- to over 100 °C
allow place in oven / pressure cooker
*do **not** accept disinfectant*
allow other suitable method – e.g. use of UV
- 1

- (c) to prevent microorganisms entering from the air
allow bacteria / fungi / microbes for microorganisms
*do **not** accept viruses*
ignore germs
- 1

- (d)
- | | | |
|---|--------------|----------|
| 0 | olive-green | 7 |
| 1 | olive-green | 7 |
| 2 | olive-green | 7 |
| 3 | orange-green | 6 |

all correct for 1 mark

1

- (e) (pH meter) – more accurate / more precise
allow more exact
allow can measure to 0.1 pH unit
or *to smaller intervals of pH*
- 1

(leaving...6 days) – obtain greater pH change
or
 because there was (very) little change in 3 days
allow more acid will be made

1

- (f) scale $> \frac{1}{2}$ of x-axis
and
 x-axis labelled (time in) days

1

points plotted correctly
all 7 correct = 2 marks
5 or 6 correct = 1 mark

2

line of best fit = smooth curve through points
*do **not** accept ruled point-to-point*

1

- (g) (1st day) too few bacteria

1

(after day 1 more bacteria so more) acid made

1

(days 5-6) sugar / food used up
or
 low pH denatures enzymes
or
 low pH kills bacteria
allow enzymes do not work
*do **not** accept enzymes killed*

1

- (h) (similarity) – same start pH /
 pH7 and end pH / pH4.5
or
 same pH change / change = 2.5

1

(difference) – faster

1

[16]

Q9.

- (a) nucleus labelled correctly

1

cell membrane labelled correctly

1

- (b) mitosis

1

- (c) electron (microscope) 1
- (d) higher magnification 1
- (e) 45 (mm) 1
- 45 / 250 **or** 0.18 (mm)
allow ecf 1
- 180 (µm) 1
- allow 180 (µm) with no working shown for 3 marks*
- (f) 0.2 µm 1

[9]

Q10.

- (a) **C** 1
- (b) cytoplasm **and** cell membrane dividing
accept cytokinesis for 1 mark 1
- to form two identical daughter cells 1
- (c) stage 4 1
- only one cell seen in this stage 1
- (d) $(4 / 36) \times 16 \times 60$ 1
- 107 / 106.7 1
- 110 (minutes)
allow 110 (minutes) with no working shown for 3 marks 1
- (e) binary fission
do not accept mitosis 1
- (f) shortage of nutrients / oxygen 1
- so cells die
or

death rate = rate of cell division

1

[11]

Q11.

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 CO₂ 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]

Q12.

(a) (i) small amounts of dead pathogens

1

(ii) decrease

1

by 60 (%)

allow from 70(%) to 10(%)
allow other correct data treatment

(b) (i) penicillin

1

1

(ii) any **two** from:

- antibiotics only kill bacteria
allow antibiotics do not kill viruses
- some bacteria are resistant (to antibiotics)
allow MRSA not killed by antibiotics
- (correct) antibiotics not always used
allow course not completed
- deficiency disease(s) not caused by bacteria **or** cannot be treated by antibiotics
- inherited disease(s) not caused by bacteria **or** cannot be treated by antibiotics
- 'lifestyle' diseases not caused by bacteria **or** cannot be treated by antibiotics
eg heart disease / cancer
*if no other mark given allow 1 mark for not all diseases are caused by bacteria **or** some diseases are caused by viruses*

2

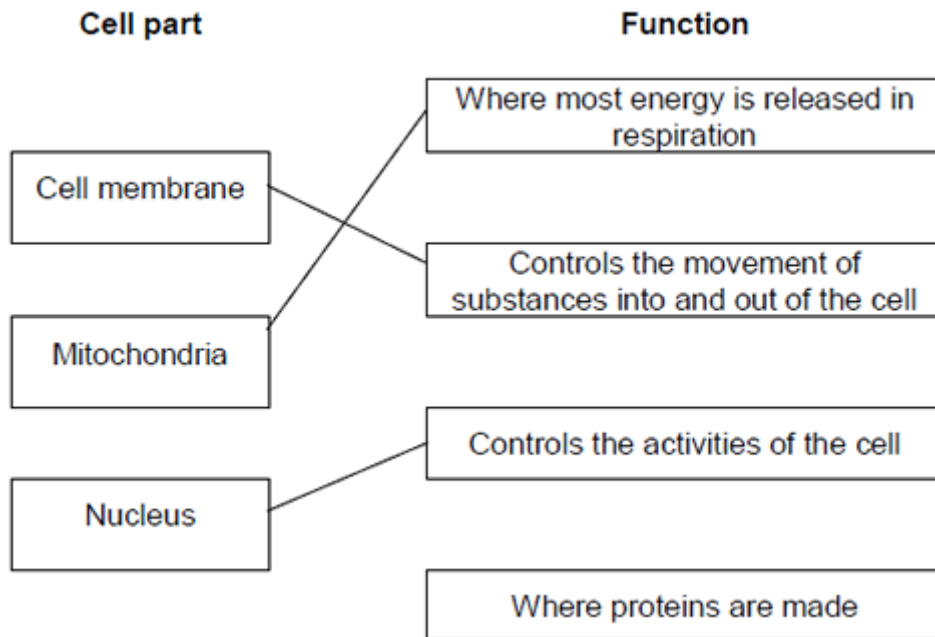
(c) bacteria grow faster

allow this is body temp (at which pathogens grow)

1

[7]

Q13.



(a)

extra lines cancel

3

(b) Cell wall

in either order

1

Chloroplast

allow (permanent) vacuole

1

[5]

Q14.

(a) a catalyst / speeds up a reaction

ignore it is not used up

1

it is a protein **or** it is specific / described **or** it has an active site

allow it only acts on one molecule

1

(b) cytoplasm

1

(c) **Advantage:**

any **one** from:

- heat would denature proteins in milk
- heat alters texture or flavour of milk
- catalase / enzyme is specific **or** only affects hydrogen peroxide
- less energy / fuel / lower temperature used so less expensive **or** less pollution

1

Disadvantage:

any **one** from:

- (some pathogens may survive) causing illness
- catalase / enzyme left in milk **or** may cause allergies **or** may alter taste

1

[5]

Q15.

(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]

Q16.

- (a) A (inoculating / wire) loop 1
- B Petri dish
allow (agar) plate
ignore ref to culture medium 1
- (b) (i) to kill (unwanted) bacteria / microorganisms / microbes
allow fungi
ignore viruses / germs 1
- (ii) Using a flame 1
- (iii) any **one** from:
 - so bacteria / microorganisms / microbes / pathogens / fungi (growing in dish) do not get out
ignore reference to gases
ignore viruses / germs
 - so bacteria / microorganisms / microbes / pathogens / fungi (from the air) do not get in.
ignore viruses / germs 1
- (c) 25 °C 1

[6]

Q17.

- (a) **A** = nucleus
allow phonetic spelling 1
- B** = (cell) membrane

(b) for repair / growth **or** to replace cells
ignore new cells / skin

1

(c) (i) embryos

1

(ii) paralysis

1

1

[5]

Q18.

(a)

Structure	Organ	Organ system	Tissue
Stomach	✓		
Cells lining the stomach			✓
Mouth, oesophagus, stomach, liver, pancreas, small and large intestine		✓	

all 3 correct = 2 marks
 2 correct = 1 mark
 1 or 0 correct = 0 marks

2

(b) (i) diffusion
allow phonetic spelling

1

(ii) glucose

1

(iii) mitochondria

1

[5]

Q19.

(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 2
- 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
- (c) to transfer energy for use 1
- allow to release / give / supply / provide energy*
*do **not** allow to 'make' / 'produce' / 'create' energy*
allow to make ATP
ignore to store energy
- by (aerobic) respiration **or** from glucose 1
- do **not** allow anaerobic*
*energy released **for** respiration = max 1 mark*
- (d) (i) to make protein / enzyme 1
- ignore 'antibody' or other named protein*
- (ii) too small / very small 1
- allow light microscope does not have sufficient magnification / resolution*
allow ribosomes are smaller than mitochondria
ignore not sensitive enough
ignore ribosomes are transparent

[8]

Q20.

- (a) (i) chloroplast 1
- (ii) cell wall 1
- (b) (i) osmosis 1
- accept diffusion*
- (ii) cell wall (prevents bursting) 1
- (c) (i) carbon dioxide 1
- allow correct formula*
- glucose

allow sugar / starch

1

(ii) any **two** from:

- light sensitive spot detects light
- tells flagellum to move towards light
- more light = more photosynthesis

2

(d) (cell has) larger SA:volume ratio

1

short (diffusion) distance

allow correct description

1

(diffusion) via cell membrane is sufficient / good enough

or

flow of water maintains concentration gradient

1

[11]

Q21.

(a) (i) xylem

1

(ii) water

1

minerals / ions / named example(s)

ignore nutrients

1

(b) (i) movement of (dissolved) sugar

allow additional substances, eg amino acids / correct named sugar (allow sucrose / glucose)

allow nutrients / substances / food molecules if sufficiently qualified

ignore food alone

1

(ii) sugars are made in the leaves

1

so they need to be moved to other parts of the plant for respiration / growth / storage

1

(c) (i) mitochondria

1

(ii) for movement of minerals / ions

Do not accept 'water'

against their concentration gradient

1

1

[9]

Q22.

(a) any **two** from:

- only one 'chromosome'
allow one strand of DNA
- circular
allow loop
- may have plasmids
- not in a nucleus / no nucleus

2

(b) (i) any **one** from:

- London is much higher
or converse
- more variable / wider range
allow 'on average it is 5 / 6 times greater'

1

(ii) increases

Included figures must be correct

1

(iii) overall slight increase

accept 'doesn't change much'

1

variable / goes up and down

1

(c) (i) both axes correctly labelled

x = Year

y = Number of cases

1

correct points

all correct = 2 marks

1-2 errors = 1 mark

> 2 errors = 0 marks

2

suitable line of best fit

accept straight line or smooth curve

1

(ii) doesn't fit the pattern / line of best fit

- (d) provides immunity / protection (to TB) 1
ignore 'stops people catching it'
ignore 'resistance' 1
- prevents TB spreading 1
accept ref to herd immunity 1

[13]

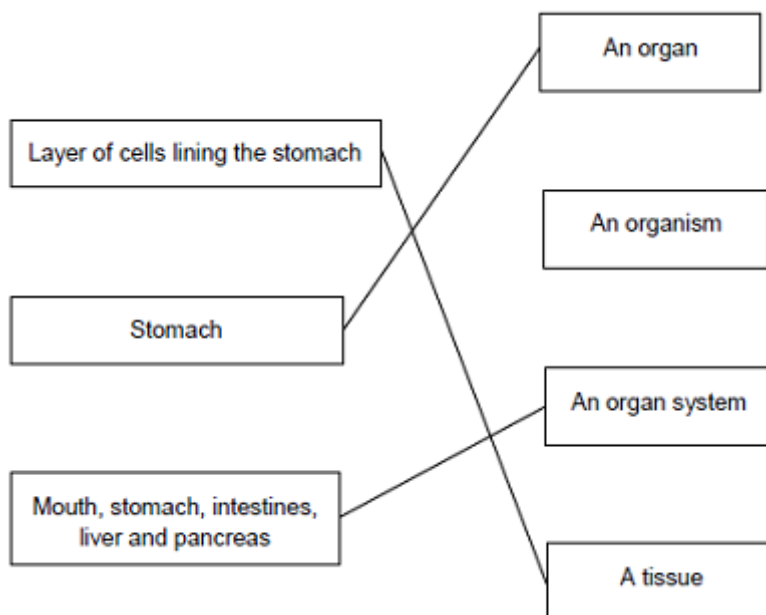
Q23.

- (a) (i) Chromosomes 1
- (ii) Characteristics 1
- (iii) Classify 1
- (b) Plants 1
ignore algae 1

[4]

Q24.

- (a) (i) A = (cell) membrane 1
- B = cytoplasm 1
*do **not** accept cytoplasm* 1
- (ii) To control the activities of the cell 1
- (b)



extra lines cancel

3

[6]

Q25.

- (a) 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 refer to the information in the [Marking guidance](#), and apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)

There is a brief description of at least one of the stages (pre-inoculation, inoculation, post-inoculation).

Level 2 (3-4 marks)

There is a simple description of at least two stages and an explanation of at least one of them.

Level 3 (5-6 marks)

There is a clear description of all three stages and an explanation of at least two of them.

Examples of Biology points made in the response:

Pre-inoculation

- Petri dish and agar sterilised before use
- to kill unwanted bacteria
- inoculating loop passed through flame / sterile swab
- to sterilise / kill (other) bacteria

Inoculation

- loop/swab used to spread/streak bacterium onto agar

Allow other correct methods, eg bacterial lawns

- lid of Petri dish opened as little as possible
- to prevent microbes from air entering

Post-inoculation

- sealed with tape
- to prevent microbes from air entering
- incubate
- to allow growth of bacteria

6

- (b) (i) bacteria killed / destroyed
ignore fights / attacks / stops growth / got rid of

1

- (ii) *Might be correct*

largest area / space where no bacteria are growing
allow most bacteria killed

1

Might not be correct

(need more evidence as) D may be harmful to people / animals / surfaces

ignore ref to cost / dangerous or harmful unqualified

1

or may work differently with different bacteria

or disinfectants may be different concentrations

ignore different amounts of disinfectant unless reference to different drop size

or may not last as long

ignore take longer to work

allow reference to anomalous result or not repeated

[9]

Q26.

- (a) (i) A = nucleus

1

B = (cell) membrane

1

- (ii) any **two** from:
ignore shape
- no (cell) wall
 - no (large / permanent) vacuole
 - no chloroplasts / chlorophyll
- 2
- (b) because high to low oxygen / concentration **or** down gradient
allow 'more / a lot of oxygen molecules outside'
ignore along / across gradient
- 1
- (c) a tissue
- 1
- [6]**

Q27.

- (a) (i) mitochondrion / mitochondria
must be phonetically correct
- 1
- (ii) carbon dioxide / CO₂
- 1
- water / H₂O
- 1
- in either order*
*accept CO₂ but **not** CO²*
*accept H₂O **or** HOH but not H²O*
- (iii) diffusion
- 1
- high to low concentration
allow down a concentration gradient
- 1
- through (cell) membrane **or** through cytoplasm
*do **not** accept cell wall*
- 1
- (b) ribosomes make proteins / enzymes
- 1
- using amino acids
- 1
- part A / mitochondria provide the energy for the process
allow ATP
*do **not** accept produce or make energy*
- 1

Q28.

- (a) **A** sperm 1
- B** egg 1
- C** fertilised egg 1
- D** embryo 1
- (b) insert into mother 1
ignore fertilise / check fertilisation / check viability
- womb / uterus 1
- (c) (i) one quarter 1
- (ii) no / little chance of success over 42 1
 reference to table of only two women in the age bracket 40-42 years became pregnant
the statement 'only 2 out of 53 40-42 year old women became pregnant / had babies' gains 2 marks 1
- (iii) so fewer twins / multiple births 1
or
 multiple births more dangerous 1

[10]

Q29.

- (a) (i) **C and D** 1
no mark if more than one box is ticked
- (ii) any **one** from: 1
*do **not** allow if other cell parts are given in a list*
- (have) cell wall(s)
 - (have) vacuole(s)
- (b) (i) **A** 1
apply list principle

- 1
- (ii) **D**
apply list principle
- 1
- (c) respiration
apply list principle
- 1
- [5]**

Q30.

- (a) **B**
*no mark for "B" alone, the mark is for B **and** the explanation.*
- large(r) surface / area **or** large(r) membrane
accept reference to microvilli
ignore villi / hairs / cilia
accept reasonable descriptions of the surface eg folded membrane / surface
*do **not** accept wall / cell wall*
- 1
- (b) (i) any **one** from:
- (salivary) amylase
 - carbohydrase
- 1
- (ii) many ribosomes
*do **not** mix routes. If both routes given award marks for the greater.*
- 1
- ribosomes produce protein
accept amylase / enzyme / carbohydrase is made of protein
- or**
- (allow)
- many mitochondria (1)
- mitochondria provide energy to build / make protein (1)
accept ATP instead of energy
- 1
- [4]**

Q31.

- (a) both parents **Aa**
*accept other upper and lower case letter without key **or***

*symbols with a key
allow as gametes shown in Punnett square*

1

aa in offspring correctly derived from parents
or

aa correctly derived from the parents given
*ignore other offspring / gametes
for this mark parents do not have to be correct*

1

offspring **aa** identified as having cystic fibrosis

*may be the only offspring shown **or** circled / highlighted /
described*

1

(b) (i) any **one** from:

*accept converse if clear, eg if you (only) took one it might
have cystic fibrosis / might not be fertilised*

- (more) sure / greater chance of healthy / non-cystic fibrosis egg /
embryo / child
*accept some may have the allele
reference to 'suitable / good embryo' is insufficient*
- greater chance of fertilisation

1

(ii) **advantages**

**to gain 3 marks both advantage(s) and disadvantage(s)
must be given**

max 3

any **two** from:

*ignore references to abortion unless qualified by later
screening*

- greater / certain chance of having child / embryo without cystic
fibrosis / healthy
- child with cystic fibrosis difficult / expensive to bring up
- cystic fibrosis (gene / allele) not passed on to future generations

disadvantages

any **two** from:

- operation dangers / named eg infection
ignore risk unqualified
- ethical or religious issues linked with killing embryos
*accept wrong / cruel to embryos accept right to life argument
ignore embryos are destroyed*

- (high) cost of procedure
- possible damage to embryo (during testing for cystic fibrosis / operation)

plus

conclusion

a statement that implies a qualified value judgement
eg it is right because the child will (probably) not have cystic fibrosis even though it is expensive

or

eg it is wrong because embryos are killed despite a greater chance of having a healthy baby

***note:** the conclusion mark cannot be given unless a reasonable attempt to give both an advantage and a disadvantage is made*

*do **not** award the mark if the conclusion only states that advantages outweigh the disadvantages*

1

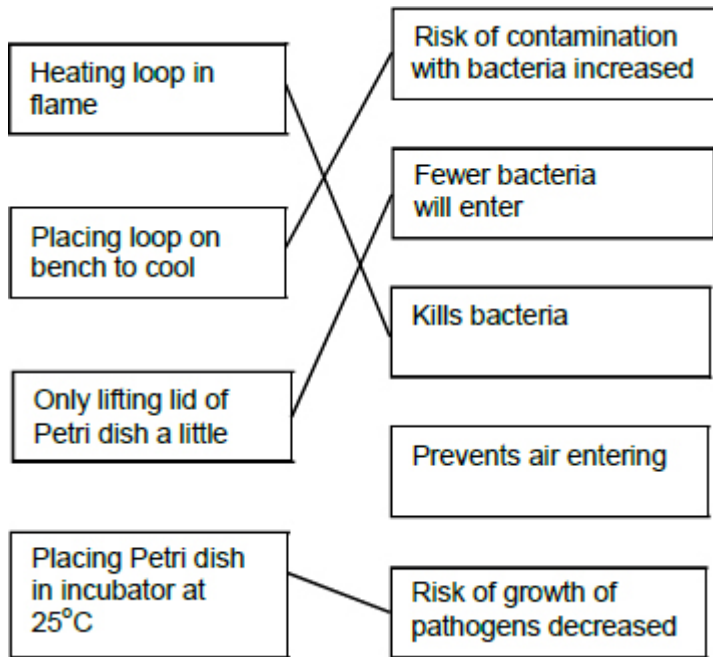
(c) any **three** from:

- osmosis / diffusion
*do **not** accept movement of ions / solution by osmosis / diffusion*
- more concentrated solution outside cell / in mucus
assume concentration is concentration of solute unless answer indicates otherwise or accept correct description of 'water concentration'
- water moves from dilute to more concentrated solution
allow correct references to movement of water in relation to concentration gradient
- partially permeable membrane (of cell)
allow semi / selectively permeable

3

[11]

Q32.



any box on the left joined to > 1 other box - cancel

[4]

Q33.

- (a) (i) A = (cell) wall
ignore cellulose 1
- B = cytoplasm 1
- (ii) any **one** from:
accept has DNA instead of a nucleus, but not just has DNA
- bacterial cell / it has no nucleus
allow no mitochondria
 - DNA free in cytoplasm
ignore size
 - has no vacuole / no vesicles
ignore strands of DNA 1
- (b) (i) yeast grows best / better / well **or** optimum temperature for yeast / more yeast present
allow yeast works best / better / well 1
- (yeast) makes CO₂ **or** respire / respiration
allow fermentation 1
- (ii) bacterium grows best / better / well / more bacteria present **or** optimum

temperature for bacterium
ignore microorganisms / microbes
allow works / respire best / better / well 1

(bacterium) makes (lactic) acid
*do **not** allow wrong acid* 1

[7]

Q34.

(a) (i) **A** – (cell) wall 1

B – cytoplasm 1

C – plasmid 1

(ii) bacterium cell has cell wall / no nucleus / no mitochondria / plasmids present
accept its DNA / genetic material is not enclosed / it has no nuclear membrane
it = bacterium cell
accept converse for animal cell
ignore flagella 1

(iii) any **one** from:
 • chloroplast
ignore chlorophyll
 • (permanent) vacuole 1

(b) (Long tail) moves the sperm / allows the sperm to swim 1

towards the egg
allow correct reference to other named parts of the female reproductive system 1

(Mitochondria) release energy (for movement / swimming)
allow supply / produce / provide 1

in respiration 1

[9]

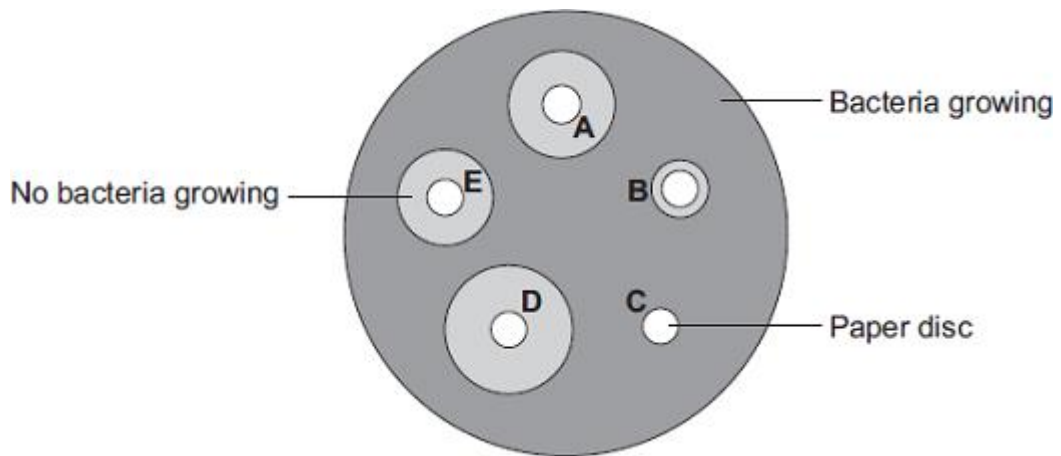
Q1.

Students in a school investigated the effect of five different antibiotics, **A**, **B**, **C**, **D** and **E**, on one type of bacterium.

The students:

- grew the bacteria on agar jelly in a Petri dish
- soaked separate paper discs in each of the antibiotics
- put the paper discs onto the bacteria in the Petri dish
- put the Petri dish into an incubator.

The diagram shows what the Petri dish looked like after 3 days.



- (a) (i) What is the maximum temperature the incubator should be set at in the school?

Draw a ring around your answer.

10°C

25°C

50°C

(1)

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

The incubator should **not** be set at a higher temperature because the higher

temperature might help the growth of

pathogens.

toxins.

viruses.

(1)

- (b) Which antibiotic, **A**, **B**, **C**, **D** or **E**, would be best to treat a disease caused by this type of bacterium?

Write your answer in the box.

Give the reason for your answer.

(2)

(c) Antibiotics **cannot** be used to treat diseases caused by viruses.

Why?

Tick (✓) **one** box.

Viruses are not pathogens

There are too many different types of virus

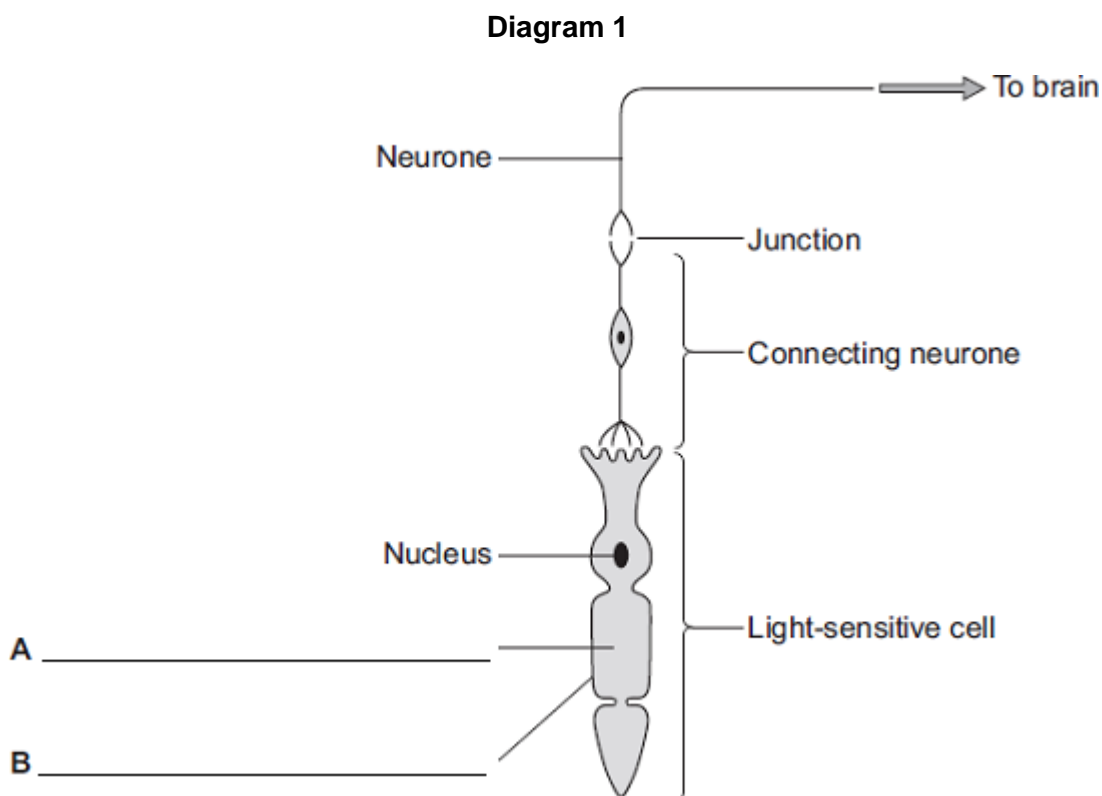
Viruses live inside cells

(1)

(Total 5 marks)

Q2.

Diagram 1 shows cells from the light-sensitive layer in the eye.



(a) On **Diagram 1**, add labels to name part **A** and part **B** of the light-sensitive cell. (2)

(b) There is a junction between the connecting neurone and the neurone carrying the impulse to the brain.

(i) What name is given to the junction?

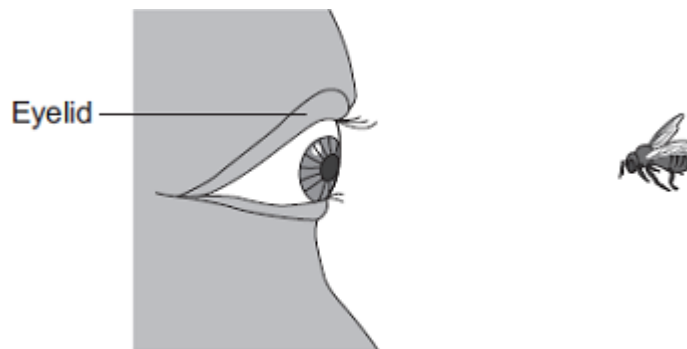
_____ (1)

(ii) In what form is information passed across the junction?

_____ (1)

(c) **Diagram 2** shows a bee flying towards a man's eye.

Diagram 2



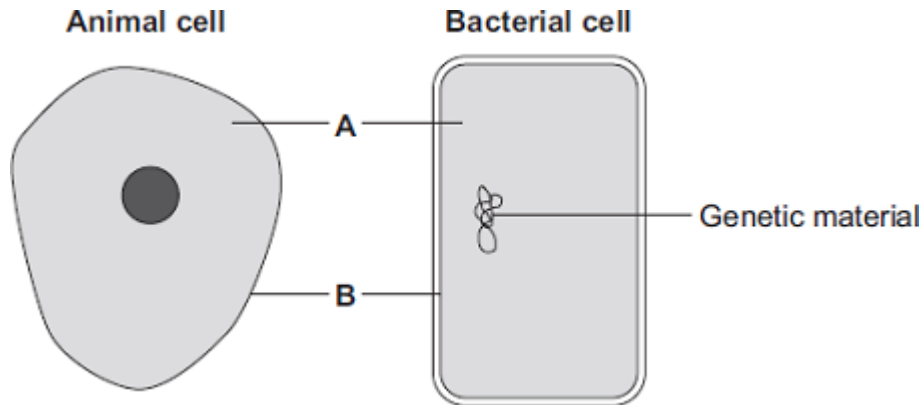
In the *blink reflex*, light from the bee reaches the light-sensitive cell in the eye. The muscles in the eyelid shut the man's eye before the bee hits the eye.

Describe the pathway taken by the nerve impulse in the *blink reflex*.

(4)
(Total 8 marks)

Q3.

The diagrams show an animal cell and a bacterial cell.



- (a) (i) Structures **A** and **B** are found in both the animal cell and the bacterial cell.

Use words from the box to name structures **A** and **B**.

cell membrane	chloroplast	cytoplasm	vacuole
---------------	-------------	-----------	---------

A _____

B _____

(2)

- (ii) Both cells contain genetic material.

Name the structure in the animal cell that contains genetic material.

(1)

- (b) **List A** gives three structures found in animal cells.

List B gives four functions of cell structures.

Draw **one** line from each structure in **List A** to its correct function in **List B**.

List A – Structure

List B – Function

Cell membrane

Controls what substances enter the cell

Mitochondrion

Ribosome

Photosynthesis

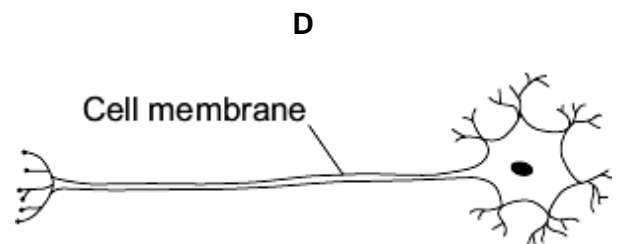
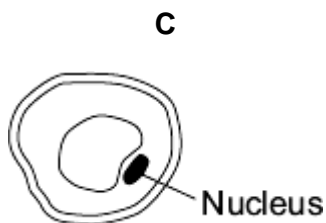
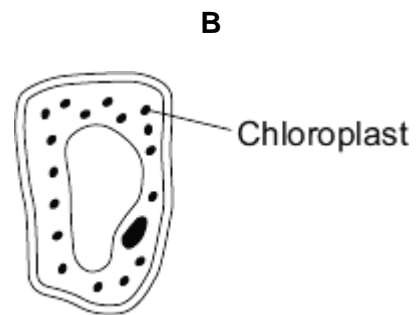
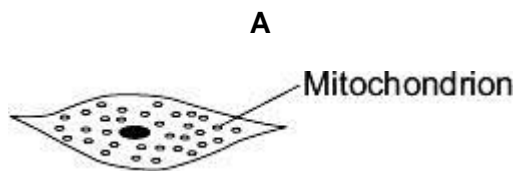
Protein synthesis

Respiration

(3)
(Total 6 marks)

Q4.

The diagrams show four cells, **A**, **B**, **C** and **D**.



Use letters **A**, **B**, **C** or **D** to answer these questions.

(a) Which cell can photosynthesise?

(1)

(b) Which cell is adapted for receiving and sending information?

(1)

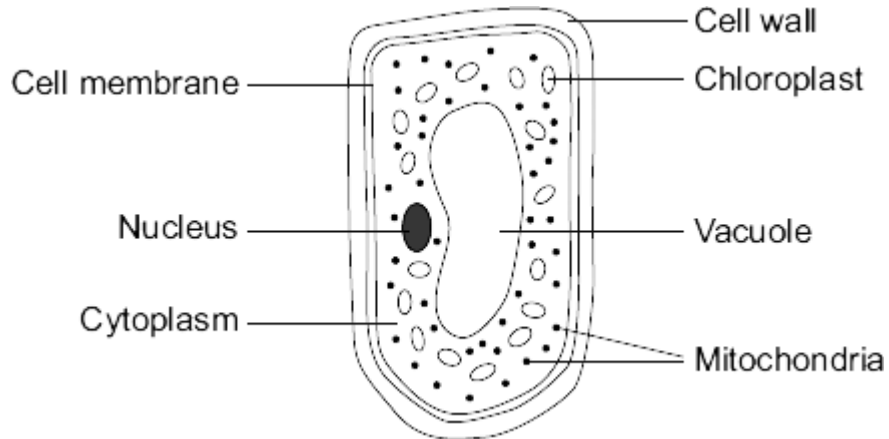
(c) Which cell is adapted to respire quickly?

(1)

(Total 3 marks)

Q5.

The diagram shows a cell from a plant leaf.



(a) Name the part of this cell that:

(i) controls the passage of substances in and out of the cell

(1)

(ii) is filled with cell sap.

(1)

(b) Give the names of **two** parts of the leaf cell that would **not** be found in a human liver cell.

_____ and _____

(2)

(c) The chloroplasts produce oxygen.

Draw a ring around the correct answer to complete the sentence.

The oxygen produced by the chloroplasts passes out of the cell by

- diffusion.

digestion.

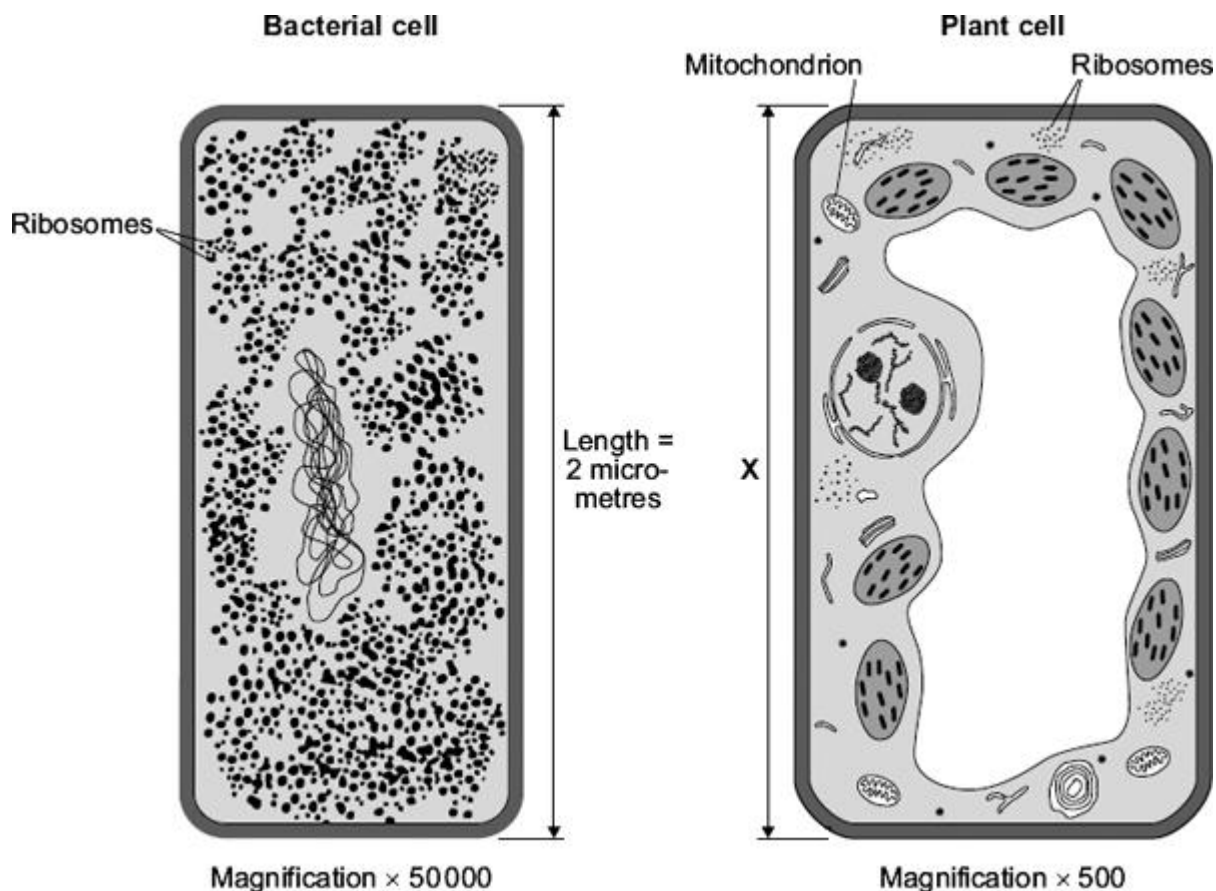
respiration.

(1)

(Total 5 marks)

Q6.

The diagram shows two cells, a bacterial cell and a plant cell.



- (a) (i) Both the bacterial cell and the plant cell contain ribosomes.

What is the function of a ribosome?

(1)

- (ii) The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Give **one** other way in which the plant cell is different from the bacterial cell.

(1)

- (b) (i) Both cells are drawn the same length, but the magnification of each cell is different.

The real length of the bacterial cell is 2 micrometres.
 Calculate the real length, **X**, of the plant cell. Give your answer in micrometres.

Show clearly how you work out your answer.

$X =$ _____ micrometres

(2)

- (ii) Most mitochondria are about 3 micrometres in length.

The plant cell contains mitochondria but the bacterial cell does **not** contain mitochondria.

Use your answer to part (b)(i) and the information in the diagram to suggest why.

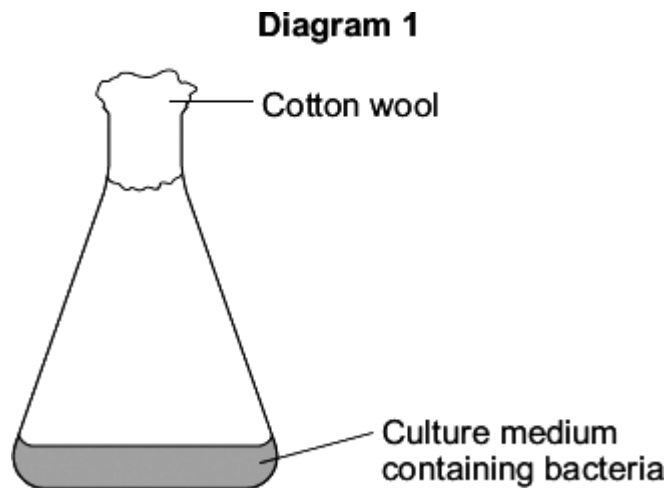
(1)

(Total 5 marks)

Q7.

Some students grew one species of bacterium in a flask.

Diagram 1 shows the flask.



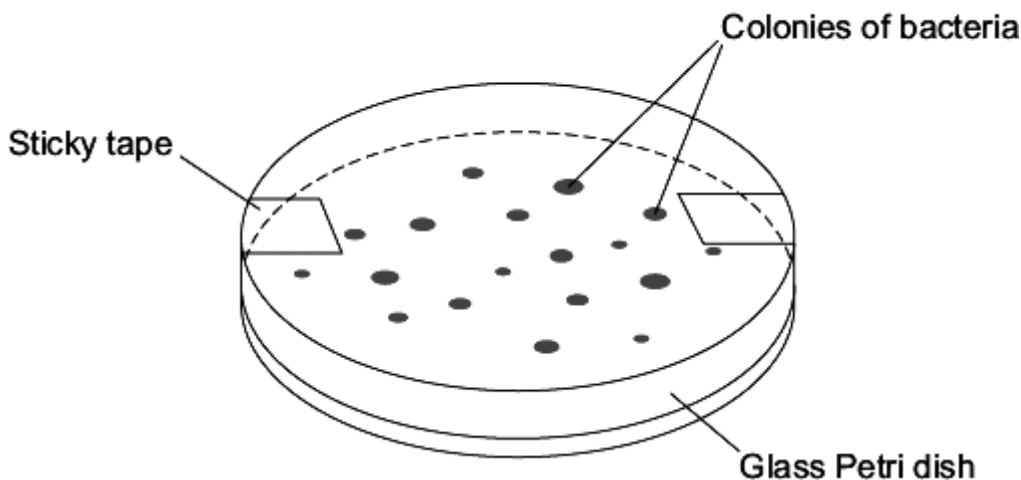
The students wanted to find the number of bacteria in 1 cm³ of the culture medium.

The students:

- diluted 1 cm³ of the culture medium from the flask with 999 cm³ of water
- added 1 cm³ of diluted culture to sterilised nutrient agar in a Petri dish
- placed the Petri dish in an incubator at 25 °C.

Diagram 2 shows the Petri dish after 3 days in the incubator.

Diagram 2



- (a) Each colony of bacteria is formed where one bacterium landed on the agar jelly.

How is each colony formed?

(1)

- (b) Complete the following calculation to find how many bacteria there were in 1 cm³ of the undiluted culture.

Number of colonies of bacteria in the Petri dish = _____

These colonies were formed from 1 cm³ of the culture diluted $\times 1000$.

Therefore, number of bacteria in 1 cm³ of undiluted culture = _____

(2)

- (c) It is important to sterilise the culture medium and all the apparatus before use.

Explain why.

(2)

- (d) The bacteria would grow faster at 35 °C. In a school laboratory, the Petri dish should **not** be incubated at a temperature higher than 25 °C.

Why?

(1)

(e) The students decided to repeat their investigation.

Why?

(1)

(Total 7 marks)

Q8.

The table shows the concentrations of three mineral ions in the roots of a plant and in the water in the surrounding soil.

Mineral ion	Concentration in millimoles per kilogram	
	Plant root	Soil
Calcium	120	2.0
Magnesium	80	3.1
Potassium	250	1.2

(a) (i) The plant roots could **not** have absorbed these mineral ions by diffusion.

Explain why.

(2)

(ii) Name the process by which the plant roots absorb mineral ions.

(1)

(b) How do the following features of plant roots help the plant to absorb mineral ions from the soil?

(i) A plant root has thousands of root hairs.

(1)

(ii) A root hair cell contains many mitochondria.

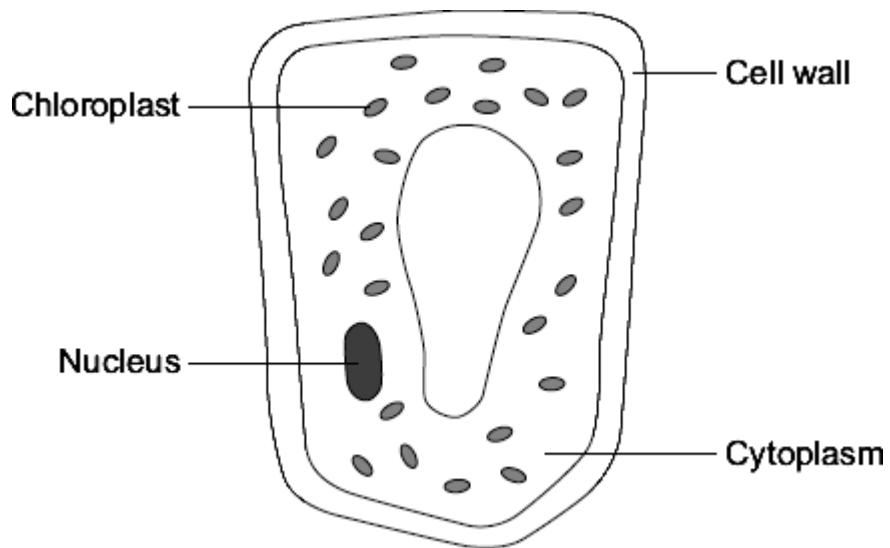
(2)

(iii) Many of the cells in the root store starch.

(1)
(Total 7 marks)

Q9.

The diagram shows a plant cell from a leaf.



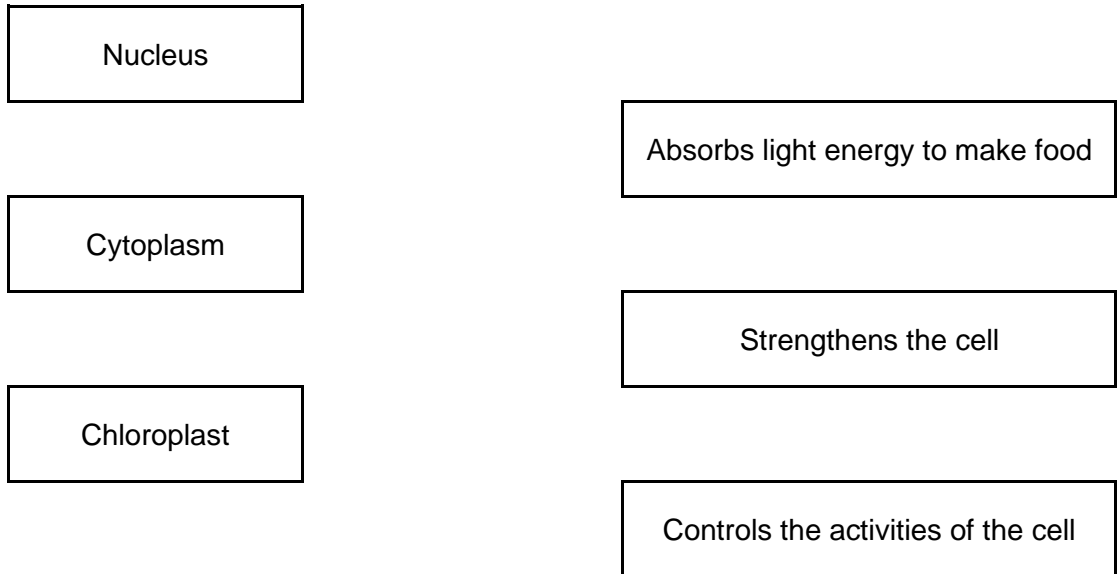
- (a) **List A** gives the names of three parts of the cell.
List B gives the functions of parts of the cell.

Draw a line from each part of the cell in **List A** to its function in **List B**.

List A
Parts of the cell

List B
Functions

Where most of the chemical reactions take place



(3)

(b) Respiration takes place in the cell.

Draw a ring around the correct answer to complete the sentence.

All cells use respiration to release

energy
oxygen.
sugar.

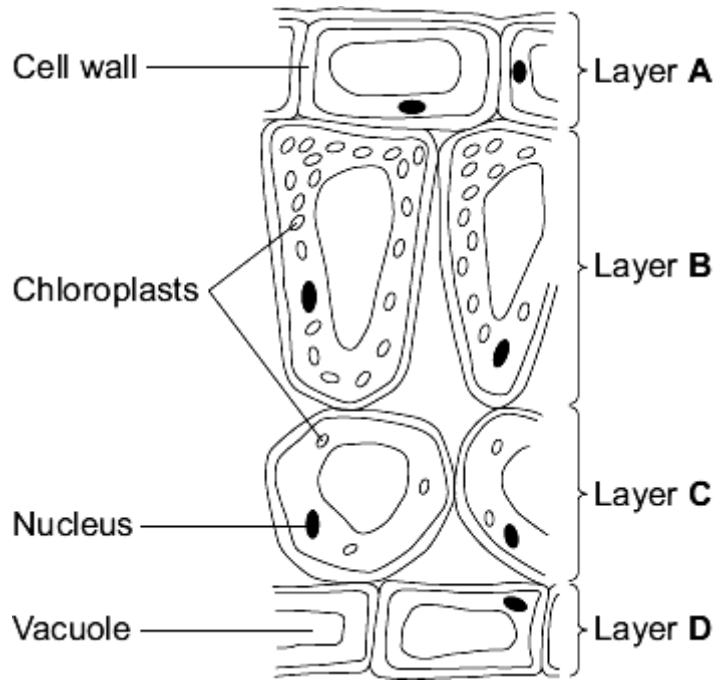
(1)

(Total 4 marks)

Q10.

Leaves are made from layers of cells.

The diagram shows a section through part of a leaf.



(a) (i) Which word in the table describes layer **A**?

Tick (✓) **one** box.

Layer A	Tick (✓)
Tissue	
Organ	
Cell	

(1)

(ii) Which word describes a whole leaf?

Draw a ring around **one** answer.

organ

tissue

organism

(1)

(b) (i) Which **two** layers of cells, **A**, **B**, **C** and **D**, can photosynthesise?

Use information from the diagram to help you.

Tick (✓) **two** boxes.

Layer **A**

Layer **B**

Layer **C**

Layer **D**

(2)

(ii) Give **one** reason for your answer.

(1)

(c) List **X** gives the names of two parts of a cell.
List **Y** gives information about parts of a cell.

Draw **one** line between each part of the cell in list **X** and information about it in list **Y**.

List X
Part of a cell

List Y
Information

Vacuole

Controls the passage of substances into the cell

Contains the cell sap

Nucleus

Controls the activities of the whole cell

(2)

(Total 7 marks)

Q11.

Cells contain a solution of salts and sugars.

A student is investigating how cells change when they are put into water.

(a) The student:

- looks at a plant cell using a microscope
- adds water to the cell.

The plant cell swells up.

Explain why, as fully as you can.

(3)

(b) When **animal** cells are put in water, they swell up, and then burst.
When **plant** cells are put in water, they swell up, but do **not** burst.

How does the structure of plant cells prevent them from bursting?

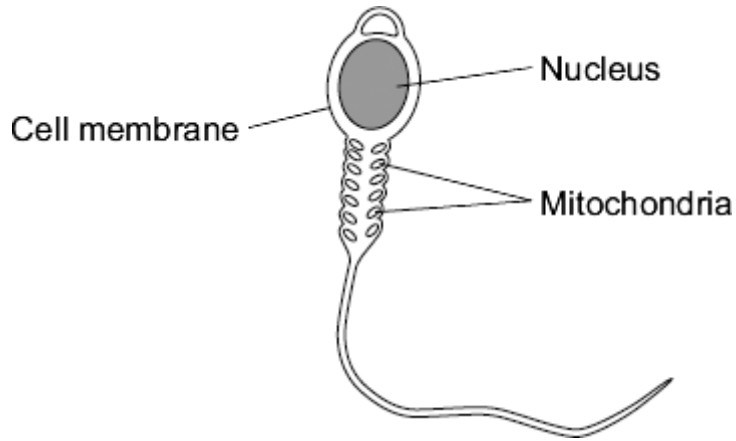
(1)

(Total 4 marks)

Q12.

Cells in the human body are specialised to carry out their particular function.

(a) The diagram shows a sperm cell.



The sperm cell is adapted for travelling to, then fertilising, an egg.

- (i) How do the mitochondria help the sperm to carry out its function?

(1)

- (ii) The nucleus of the sperm cell is different from the nucleus of body cells.

Give **one** way in which the nucleus is different.

(1)

- (b) Stem cells from human embryos are used to treat some diseases in humans.

Explain why.

(2)

(Total 4 marks)

Q13.

Humans reproduce sexually.

Draw a ring around the correct answer to complete each sentence.

- (a) (i) At fertilisation

chromosomes
genes

 join together.

sex cells

(1)

(ii) At fertilisation a single cell forms, which has new pairs of

chromosomes.
 nuclei.
 sex cells.

(1)

(b) Cystic fibrosis can be inherited by children whose parents do not have it.

(i) A person who has cystic fibrosis has

two
 three
 four

copies of the

cystic fibrosis allele.

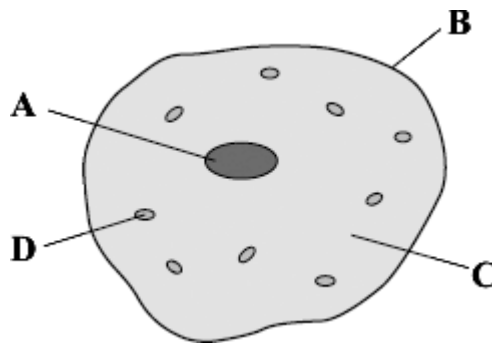
(1)

(ii) The cystic fibrosis allele is

large.
 recessive.
 strong.

(1)

(c) The diagram shows a human body cell.



Choose the correct answer from the box to complete each sentence.

cell membrane

cell wall

cytoplasm

nucleus

(i) The part of the cell labelled **B** is the _____

(1)

(ii) The part of the cell labelled **C** is the _____

(1)

(d) Which part of the cell, **A**, **B**, **C** or **D**:

(i) contains the allele for cystic fibrosis

(1)

(ii) is affected by cystic fibrosis?

(1)

(Total 8 marks)

Q14.

Plants need mineral ions for healthy growth.

(a) Which part of a plant takes in mineral ions?

Tick (✓) **one** box.

Flower

Leaf

Root

(1)

(b) Leaves are usually green.

(i) What is the green substance in leaves?

Draw a ring around your answer.

chlorophyll

glucose

starch

(1)

(ii) The green substance in leaves is important to plants.

Explain why.

(2)

- (c) A shortage of mineral ions can affect a plant.

Draw **one** line from each mineral ion to the effect of its shortage.

Mineral ion	Effect of its shortage
Magnesium	Yellow leaves
Nitrate	Stunted growth
	White flowers

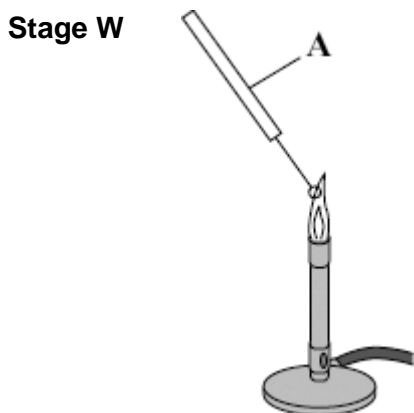
(2)
(Total 6 marks)

Q15.

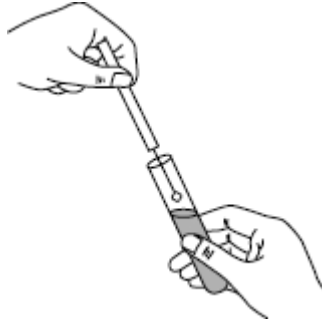
- (a) It is important to prevent contamination when growing microorganisms.

The diagram shows the transfer and culturing of microorganisms.

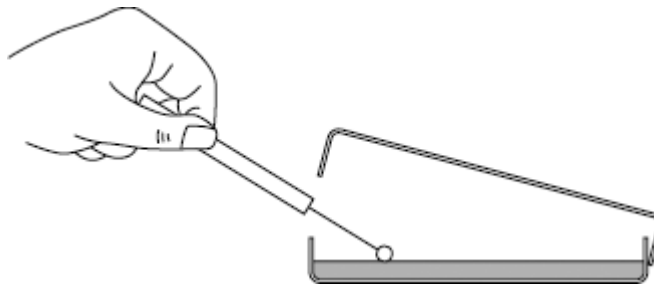
Stage V  A Petri dish with agar is heated to 150 °C for 50 minutes, then cooled



Stage X



Stage Y



Stage Z



Petri dish kept at 25 °C for 48 hours

- (i) Name the apparatus labelled **A** in stage **W**.

Draw a ring around **one** answer.

inoculating loop

pipette

thermometer

(1)

- (ii) Give the letters of the **two** stages from **V**, **W**, **X**, **Y** and **Z**, which are carried out to kill microorganisms.

Stages and

(2)

- (iii) Give the letter of the stage, **V**, **W**, **X**, **Y** or **Z**, where incubation takes place.

Stage

(1)

- (b) A culture medium used for growing microorganisms contains various nutrients.

Which nutrient is the main source of energy for the microorganisms?

Draw a ring around **one** answer.

carbohydrates

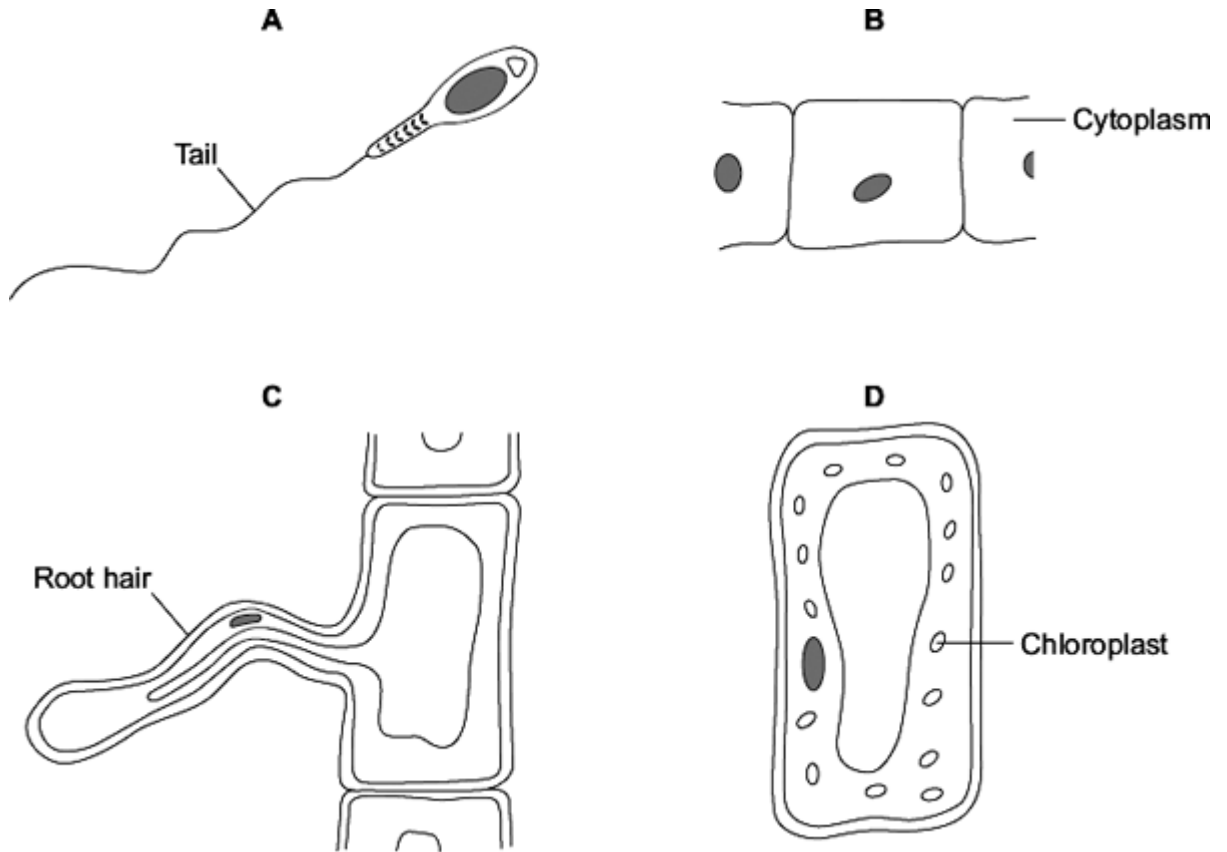
mineral ions

vitamins

(1)
(Total 5 marks)

Q16.

The diagrams show four types of cell, **A**, **B**, **C** and **D**.
Two of the cells are plant cells and two are animal cells.



(a) (i) Which **two** of the cells are plant cells?

Tick (✓) **one** box.

A and B

A and D

C and D

(1)

(ii) Which part is found **only** in plant cells?

Draw a ring around **one** answer.

cell membrane

cell wall

nucleus

(1)

(b) (i) Which cell, **A**, **B**, **C** or **D**, is adapted for swimming?

(1)

(ii) Which cell, **A**, **B**, **C** or **D**, can produce glucose by photosynthesis?

(1)

(c) Cells **A**, **B**, **C** and **D** all use oxygen.

For what process do cells use oxygen?

Draw a ring around **one** answer.

osmosis

photosynthesis

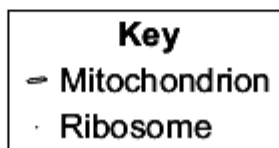
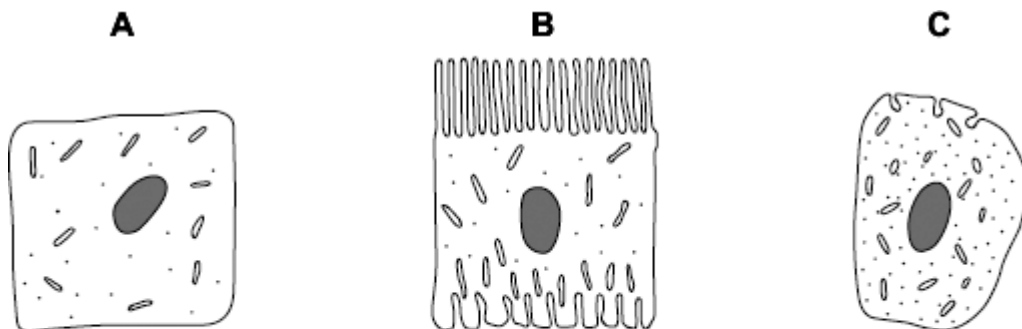
respiration

(1)

(Total 5 marks)

Q17.

Diagrams **A**, **B** and **C** show cells from different parts of the human body, all drawn to the same scale.



(a) Which cell, **A**, **B** or **C**, appears to have adaptations to increase diffusion into or out

of the cell?

Give **one** reason for your choice.

(1)

(b) (i) Cell **C** is found in the pancreas.

Name **one** useful substance produced by the pancreas.

(1)

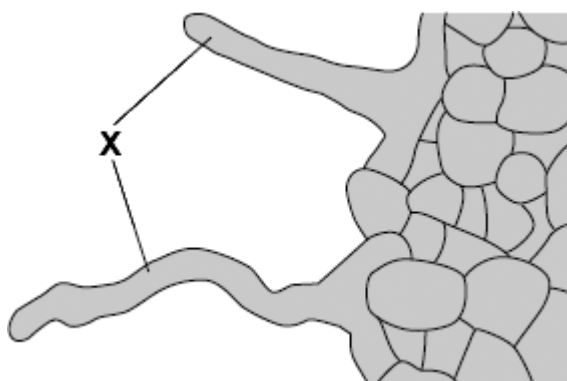
(ii) Use information from the diagram to explain how cell **C** is adapted for producing this substance.

(2)

(Total 4 marks)

Q18.

The diagram shows part of a plant root. A large number of structures like the ones labelled **X** grow out of the surface of the root.



(a) (i) What is the name of structure **X**?

Draw a ring around **one** answer.

root hair

stoma

villus

(1)

(ii) Name **two** substances which structure **X** absorbs from the soil.

1. _____
2. _____

(2)

(b) The substances in (a)(ii) are transported from the roots to the leaves. Carbon dioxide also enters the leaves.

Draw a ring round the correct answer to complete each sentence.

(i) Carbon dioxide enters leaves through

alveoli.
stomata.
villi.

(1)

(ii) Carbon dioxide enters leaf cells by

active transport.
diffusion.
reabsorption.

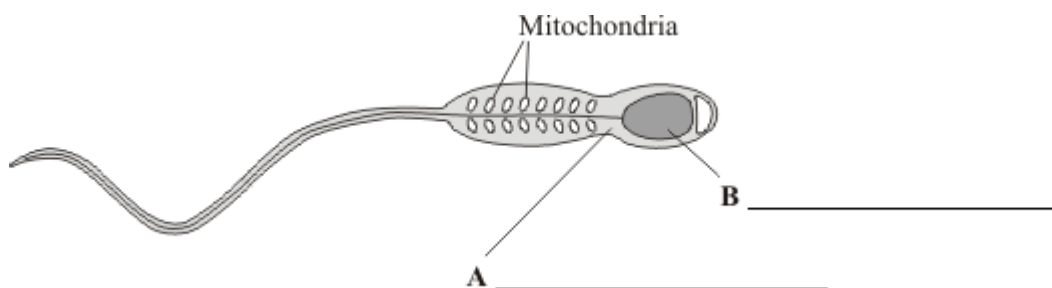
(1)

(Total 5 marks)

Q19.

This question is about cells.

(a) (i) The diagram shows a sperm cell.

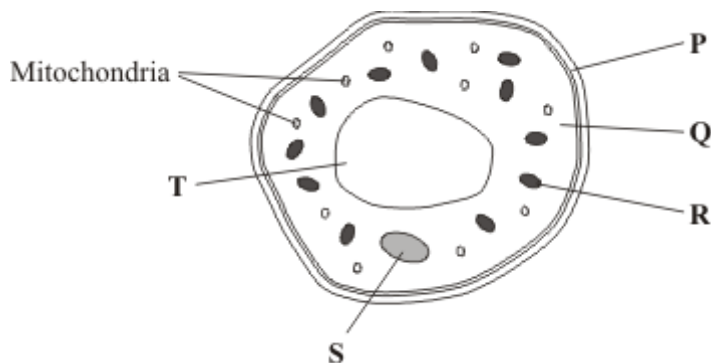


Use words from the box to label parts **A** and **B**.

cell membrane	cytoplasm	nucleus
----------------------	------------------	----------------

(2)

(ii) The diagram shows a cell from a leaf.



Give the letters of **two** parts of the leaf cell which would **not** be found in a sperm cell.

and .

(1)

(b) Sperm cells have many mitochondria.

Why do sperm cells need many mitochondria?

Tick (✓) **one** box.

Sperm cells are involved in fertilisation.

Sperm cells are produced in very large numbers.

Sperm cells need a lot of energy to swim.

(1)

(Total 4 marks)

Q20.

Some students investigated the effect of pH on the growth of one species of bacterium.

They transferred samples of bacteria from a culture of this species to each of eight flasks. Each flask contained a solution of nutrients but at a different pH.

After 24 hours, the students measured the amount of bacterial growth.

(a) It was important that the flasks in which the bacteria grew were not contaminated with other microorganisms.

Describe **two** precautions the students should have taken to prevent this contamination.

1. _____

2. _____

(2)

- (b) To see the effect of pH on the growth of the bacteria, other conditions should be kept constant.

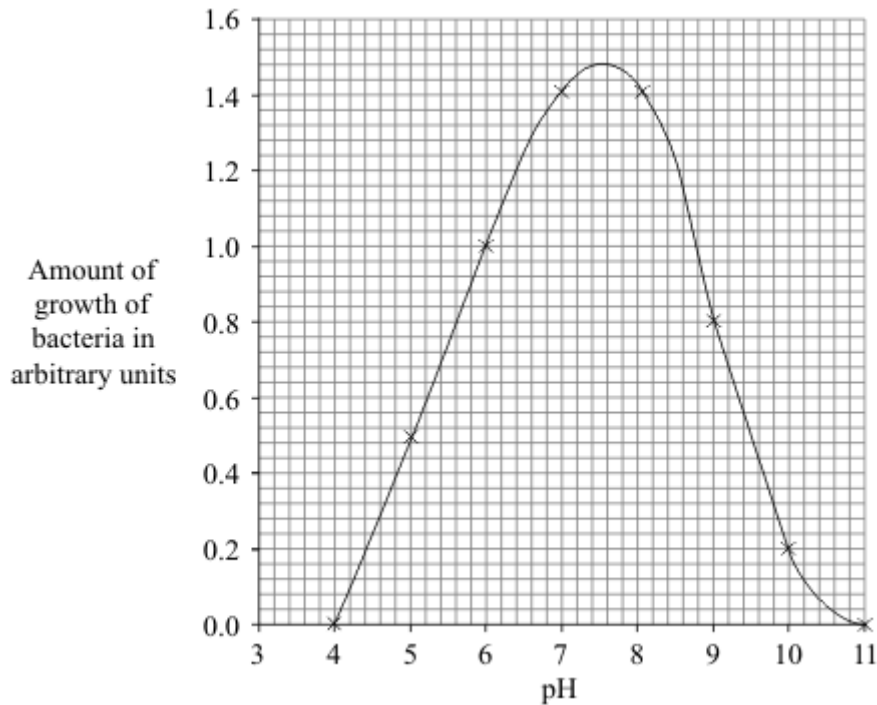
Suggest **two** conditions which should have been kept constant for all eight flasks.

1. _____

2. _____

(2)

- (c) The graph shows the results of the investigation.



The students wanted to find the best pH for the growth of this species of bacterium.

- (i) Use the graph to estimate the pH at which the bacteria would grow best.

pH _____

(1)

- (ii) What could the students do to find a more accurate value for the best pH for growth of the bacteria?

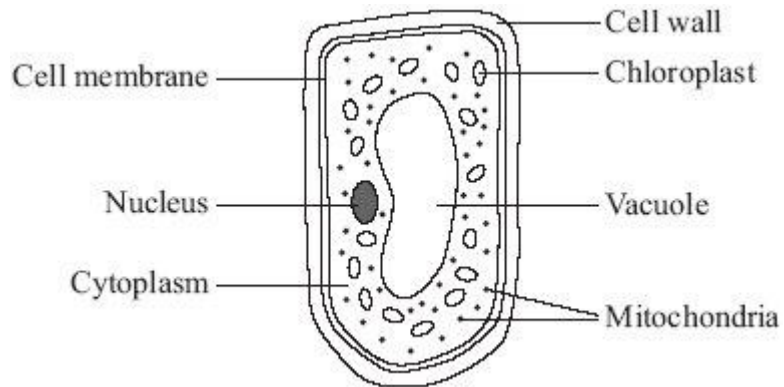
(1)

(Total 6 marks)

Q21.

Diagram 1 shows a cell from a leaf.

Diagram 1



(a) How is the leaf cell specialised to carry out photosynthesis?

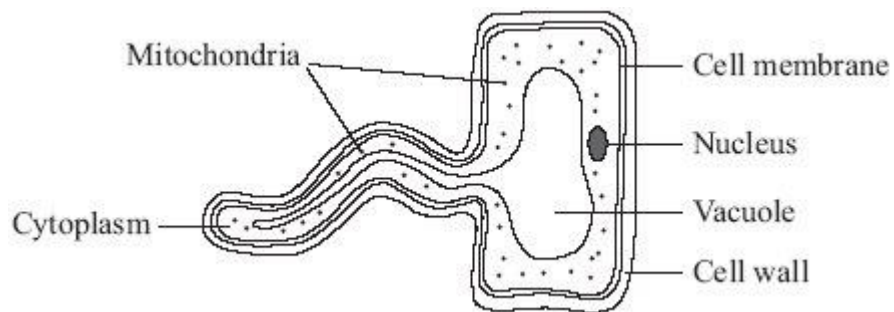
Tick (✓) **one** box.

- It has a permanent vacuole.
- It has many chloroplasts.
- It has cytoplasm.
- It has many mitochondria.

(1)

(b) **Diagram 2** shows another type of plant cell.

Diagram 2



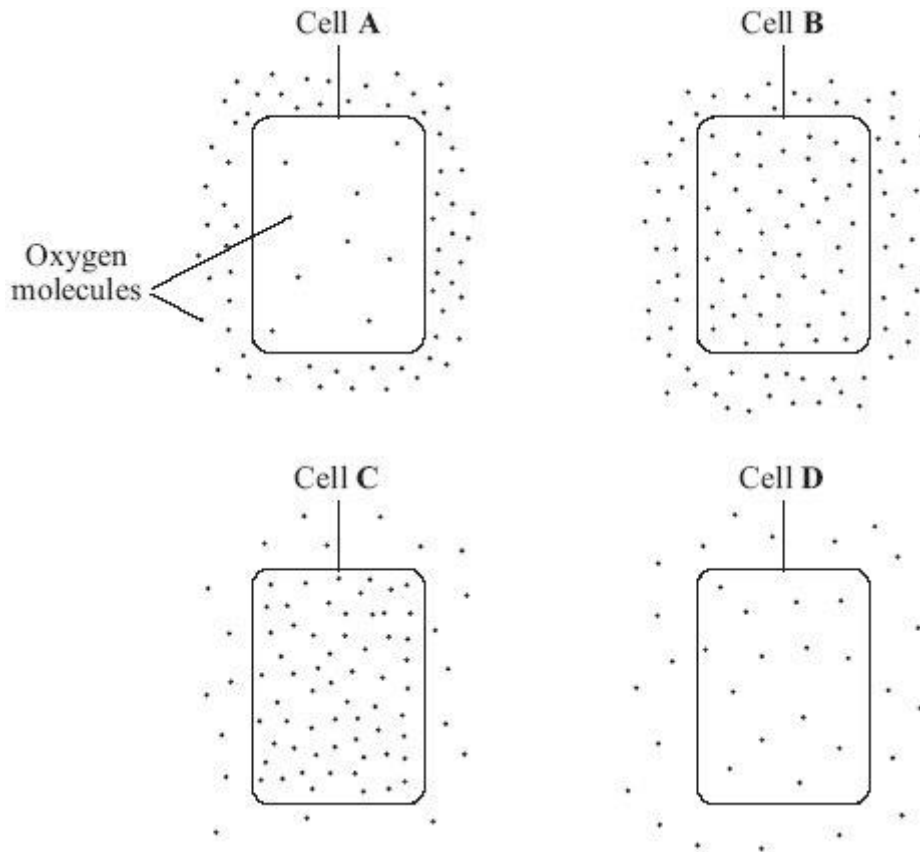
Give **two** ways in which this cell is different from an animal cell.

1. _____
- _____
2. _____
- _____

(2)
(Total 3 marks)

Q22.

- (a) The diagrams show cells containing and surrounded by oxygen molecules. Oxygen can move into cells or out of cells.



Into which cell, **A**, **B**, **C** or **D**, will oxygen move the fastest?

Write your answer, **A**, **B**, **C** or **D**, in the box.

(1)

- (b) Draw a ring around the correct word to complete each sentence.

- (i) Oxygen is taken into cells by the process of

diffusion
osmosis
respiration

(1)

- (ii) Cells need oxygen for

breathing
photosynthesis

respiration

(1)

(iii) The parts of cells that use up the most oxygen are the

membranes
 mitochondria
 nuclei

(1)

(iv) Some cells produce oxygen in the process of

diffusion
 photosynthesis
 respiration

(1)

(Total 5 marks)

Q23.

(a) Microorganisms can be grown on agar jelly in a Petri dish.

List A gives three actions used when growing microorganisms.

List B gives four possible effects of these actions.

Draw a straight line from each action in **List A** to its effect in **List B**.

List A – Action

List B – Effect

The agar jelly is heated at
 120°C for 30 minutes

To reduce the growth of
 pathogens

Make sure the temperature for
 growing the microorganisms is
 no higher than 25 °C

To kill unwanted
 microorganisms

Make sure the temperature for
 growing the microorganisms is
 no higher than 25 °C

To prevent microorganisms from
 the air getting into the Petri dish

The lid of the Petri dish is held
 on with tape

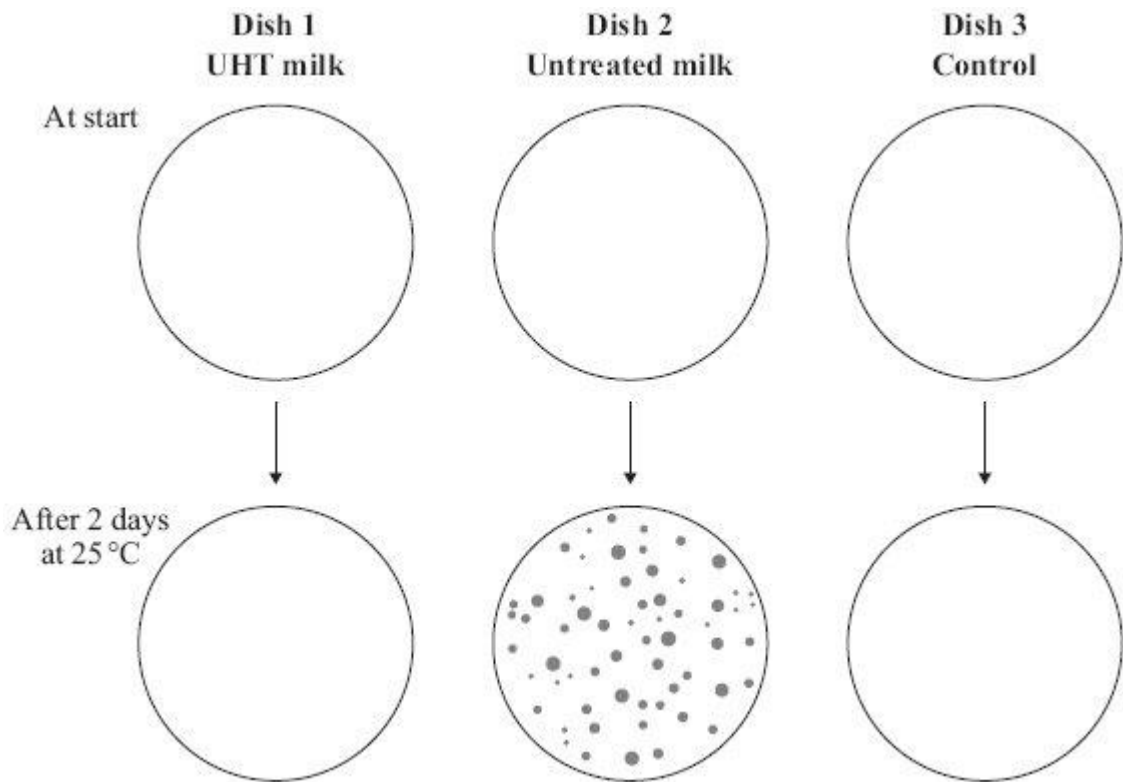
To prevent oxygen entering the
 Petri dish

(b) UHT milk is milk that has been heated to 135 °C, then cooled.

In an investigation, three sterile Petri dishes containing sterile agar jelly were set up as follows.

- UHT milk was added to dish 1.
- Untreated milk was added to dish 2.
- Dish 3 was left unopened as a control.
- The dishes were kept at 25 °C for two days.

The results are shown in the diagram below.



(i) Describe the difference in appearance between dishes 1 and 2 after two days.

(1)

(ii) Give **one** reason for this difference.

(1)

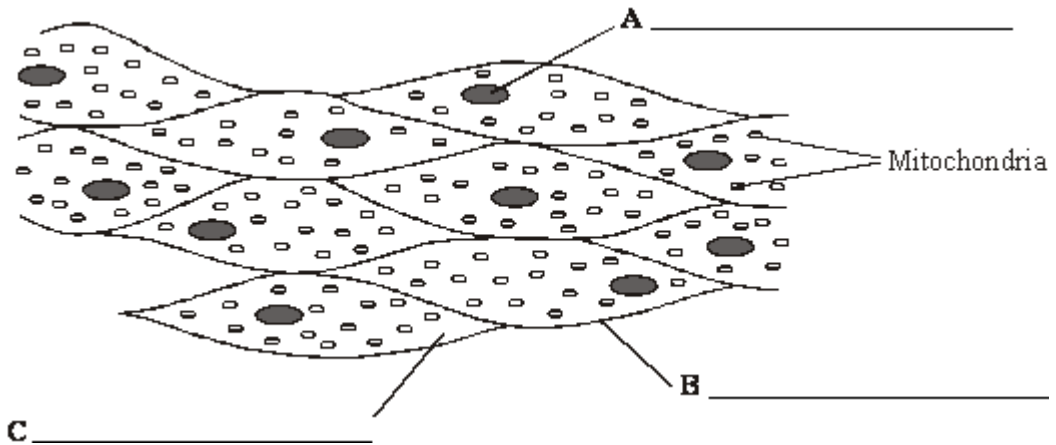
(iii) There was no change in the appearance of dish 3 after two days.

Give **one** reason why.

(1)
(Total 6 marks)

Q24.

The diagram shows a group of muscle cells from the wall of the intestine.



- (a) On the diagram, use words from the box to name the structures labelled **A**, **B** and **C**.

cell membrane	cell wall	chloroplast	cytoplasm	nucleus
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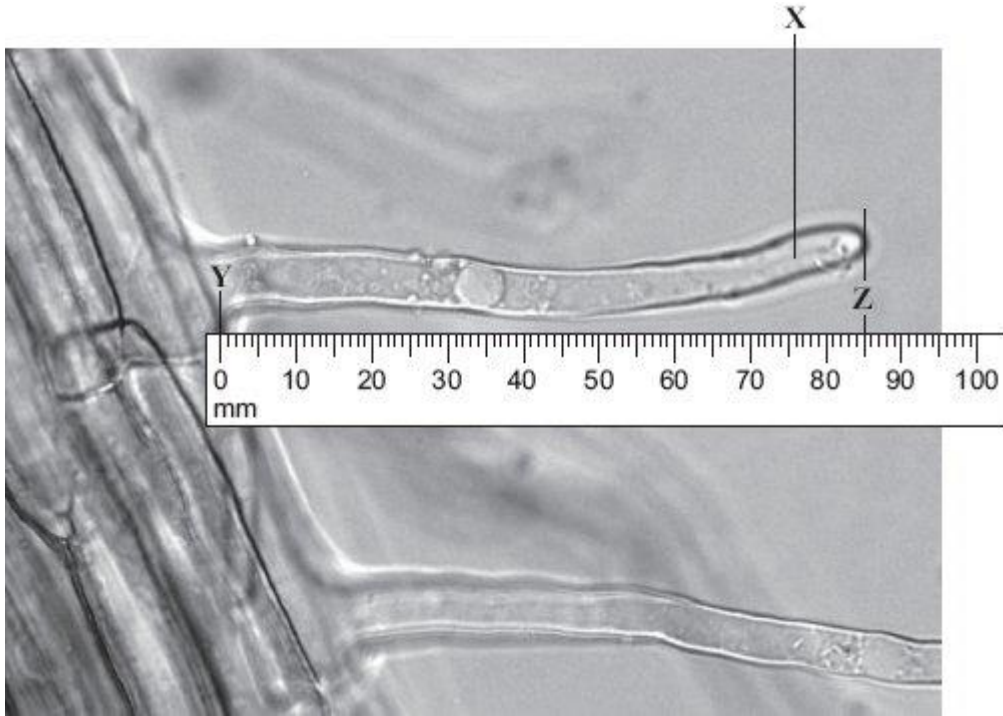
(3)

- (b) How are these muscle cells adapted to release a lot of energy?

(2)
(Total 5 marks)

Q25.

The photograph shows part of the surface of a plant root. This part of the root is covered with hundreds of structures like the one labelled **X**.



(a) What is the name of structure **X**?

Draw a ring around **one** answer.

root hair

stoma

villus

(1)

(b) (i) Use the scale to measure the length **Y–Z** on the photograph.

On the photograph, length **Y–Z** = _____ mm.

(1)

(ii) The photograph shows the root magnified 100 times.

Calculate the actual length **Y–Z**.

Actual length **Y–Z** = _____ mm.

(2)

(iii) Structure **X** is very small. There are thousands of structures like **X** on a plant root.

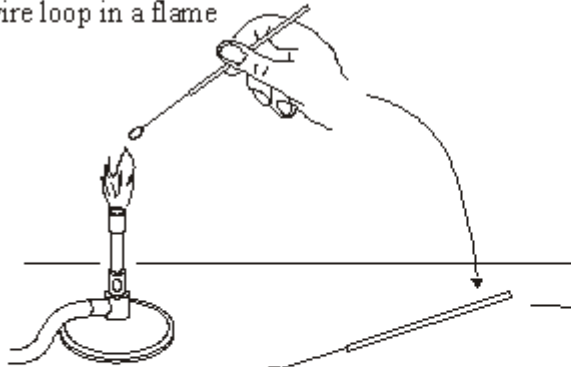
How does this help the plant?

(2)
(Total 6 marks)

Q26.

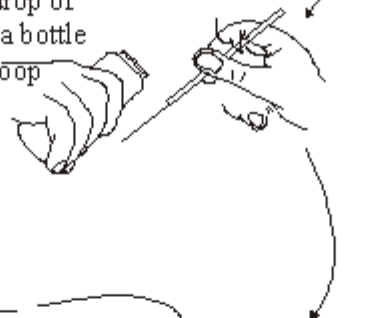
The diagram shows how a student transferred some sour milk from a bottle to a Petri dish of nutrient agar.

- 1 The student heated a wire loop in a flame

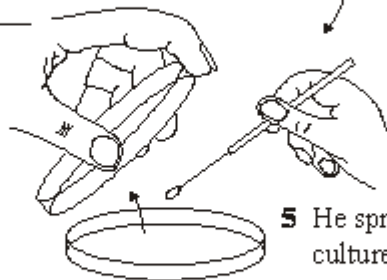


- 2 He placed the wire loop on the bench to cool

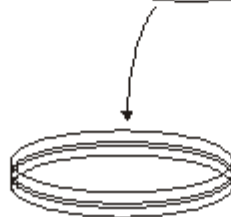
- 3 He removed a drop of sour milk from a bottle using the wire loop



- 4 He raised the lid a little from a Petri dish of sterilised nutrient agar



- 5 He spread the sample of bacterial culture across the nutrient agar



- 6 He replaced the lid and put the Petri dish in an incubator at 25 °C for 2 days

List A gives four actions carried out by the student.

List B gives five possible effects of these actions.

Draw a straight line from each action in List **A** to its effect in List **B**.
 Draw only **one** line from each action.

List A – Action	List B – Effect
Heating loop in flame	Risk of contamination with bacteria increased
Placing loop on bench to cool	Risk of bacteria entering decreased
Only lifting lid of petri dish a little	Kills bacteria
Placing petri dish in incubator at 25°C rather than 35°C	Prevents air entering
	Risk of growth of pathogens decreased

(Total 4 marks)

Q27.

The pancreas is involved in digestion and controlling the internal conditions of the body.

(a) Name **two** digestive enzymes produced by the pancreas.

1. _____
2. _____

(2)

(b) Diabetes may be caused by a lack of insulin.

Part of the treatment for someone with diabetes is to pay careful attention to the diet.

(i) Give **one** symptom of diabetes.

(1)

(ii) Give **one** way in which a diabetic may be advised to change their diet.

(1)

(iii) How does this change in diet help the diabetic?

(1)

(iv) State **one** other way in which the symptoms of diabetes may be treated.

(1)

(c) Many of the cells in the pancreas contain large numbers of ribosomes.

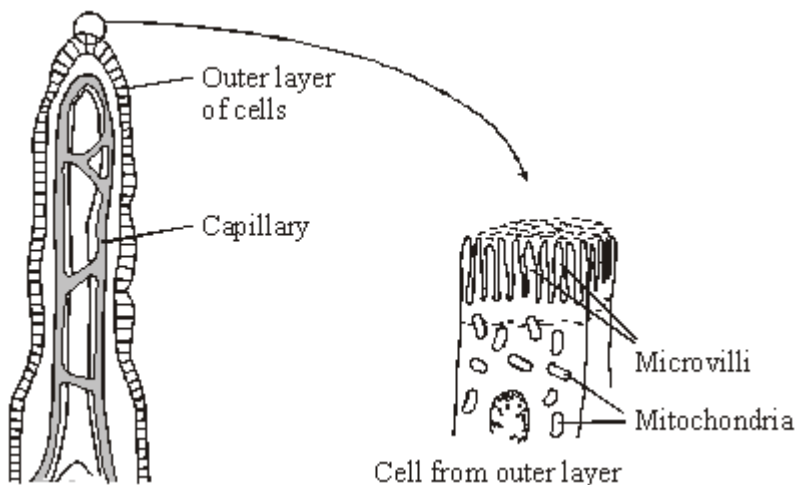
What is the function of ribosomes in a cell?

(1)

(Total 7 marks)

Q28.

The small intestine is lined with millions of villi.
The diagram shows the structure of a villus.



In the small intestine, some of the products of digestion are absorbed into the blood by *active transport*.

(a) Explain what is meant by *active transport*.

(2)

(b) How do microvilli and mitochondria help in the active transport of the products of digestion from the small intestine into the blood?

Microvilli _____

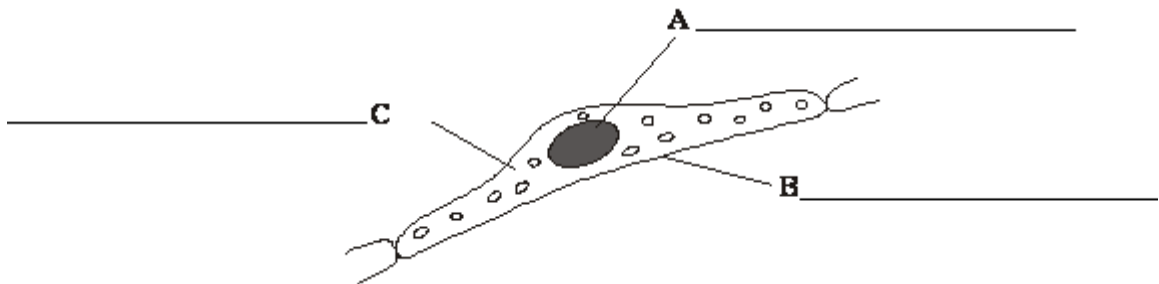
Mitochondria _____

(2)

(Total 4 marks)

Q29.

The diagram shows a cell from the lining of the lung. This cell is specialised to allow gases to pass through quickly.



(a) Use words from the box to label structures **A**, **B** and **C**.

cell	chloroplast	cytoplasm	mitochondria	nucleus
membrane				

(3)

(b) (i) Which feature of this cell allows oxygen to pass through quickly?

Put a tick (✓) in the box next to your choice.

It is thin.

It has a large nucleus.

It has many mitochondria.

(1)

- (ii) Complete the sentence by drawing a ring around the correct answer in the box.

Oxygen passes through this cell by

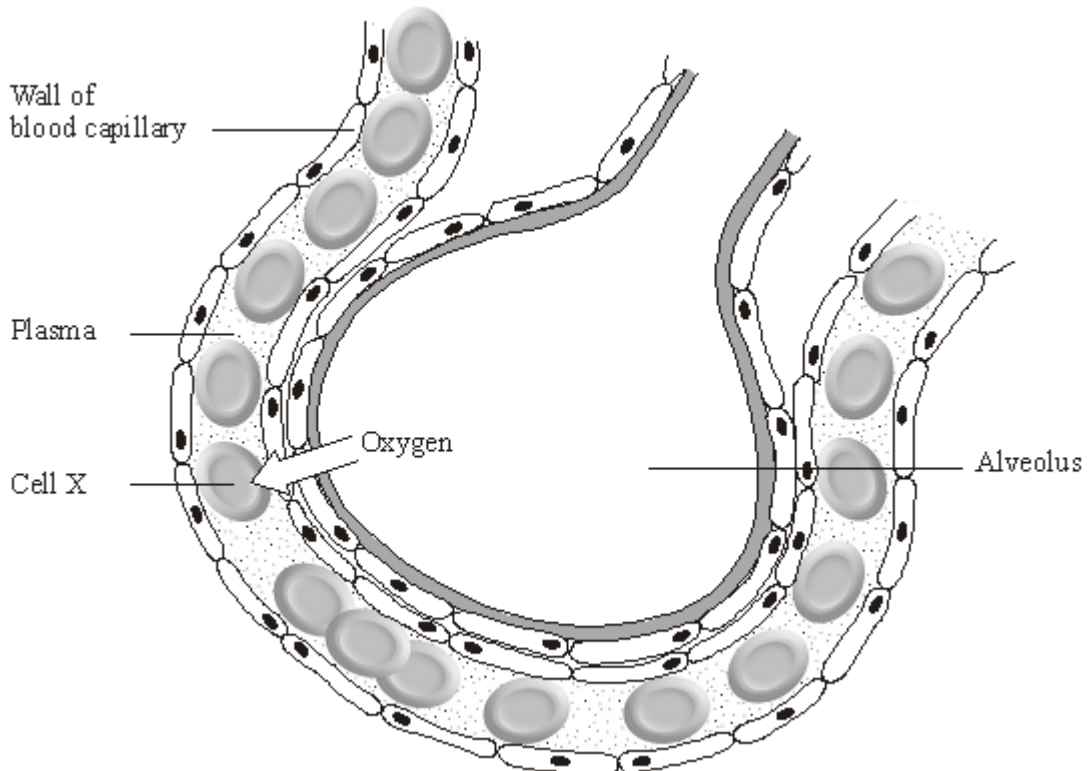
diffusion
osmosis
respiration

(1)

(Total 5 marks)

Q30.

The diagram shows a small part of a lung.



- (a) The arrow on the diagram shows the movement of oxygen from the air in the alveolus to cell X.

Complete the sentences by drawing a ring around the correct answer.

(i) Cell X is a

platelet
red cell
white cell

 (1)

(ii) Oxygen moves from the air in the alveolus into cell X by

diffusion
filtration
respiration

 (1)

(iii) The substance in cell X that combines with oxygen is called

glycogen
haemoglobin
lactic acid

 (1)

(iv) Cell X does **not** have

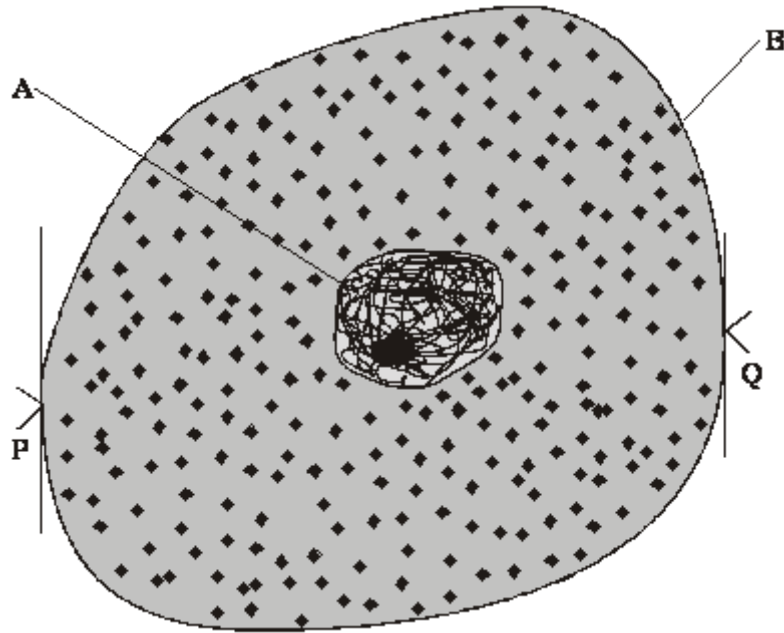
a cell membrane
cytoplasm
a nucleus

 (1)

(b) **On the diagram**, draw an arrow to show the movement of carbon dioxide during gas exchange. (1)
(Total 5 marks)

Q31.

The diagram shows an animal cell.



- (a) (i) Name structures **A** and **B** by choosing the correct words from the box.

cell membrane	cell wall	cytoplasm	nucleus	vacuole
---------------	-----------	-----------	---------	---------

Structure **A** _____

Structure **B** _____

(2)

- (ii) Which structure named in the box controls the passage of substances in and out of the cell?

(1)

- (b) Distance **P** to **Q** on the diagram is the diameter of the cell. This distance was measured on three cells using a microscope. The results were as follows:

cell 1: 63 micrometres
 cell 2: 78 micrometres
 cell 3: 69 micrometres

Calculate the average diameter of these cells. Show clearly how you work out your final answer.

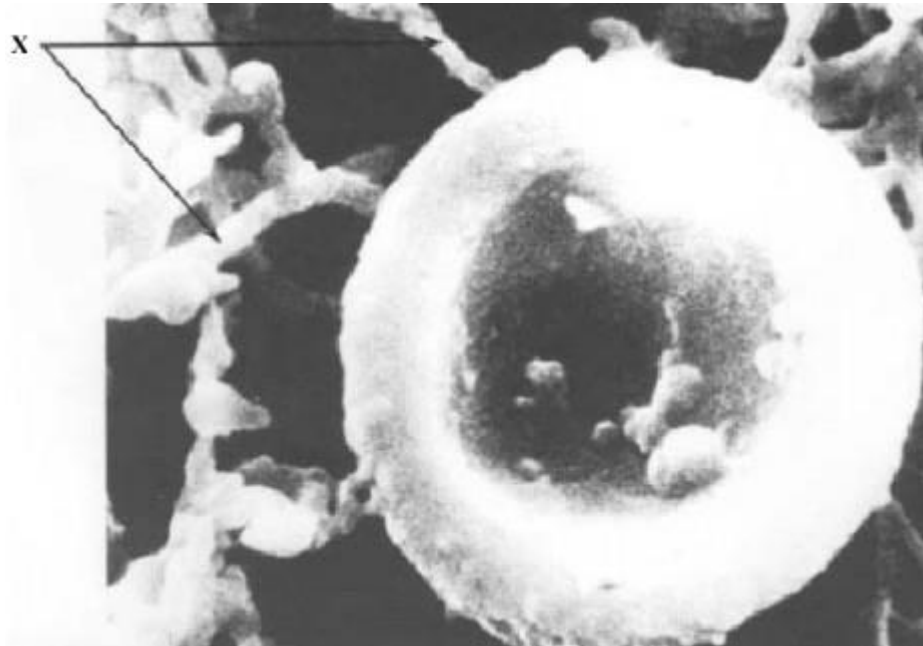
Average diameter = _____ micrometres

(2)

(Total 5 marks)

Q32.

The photograph shows a red blood cell in part of a blood clot. The fibres labelled **X** are produced in the early stages of the clotting process.



- (a) Suggest how the fibres labelled **X** help in blood clot formation.

_____ (1)

- (b) The average diameter of a real red blood cell is 0.008 millimetres.
On the photograph, the diameter of the red blood cell is 100 millimetres.

Use the formula to calculate the magnification of the photograph.

$$\text{Diameter on photograph} = \text{Real diameter} \times \text{Magnification}$$

Magnification = _____ (2)

- (c) Some blood capillaries have an internal diameter of approximately 0.01 millimetres.

- (i) Use information given in part (b) to explain why only one red blood cell at a time can pass through a capillary.

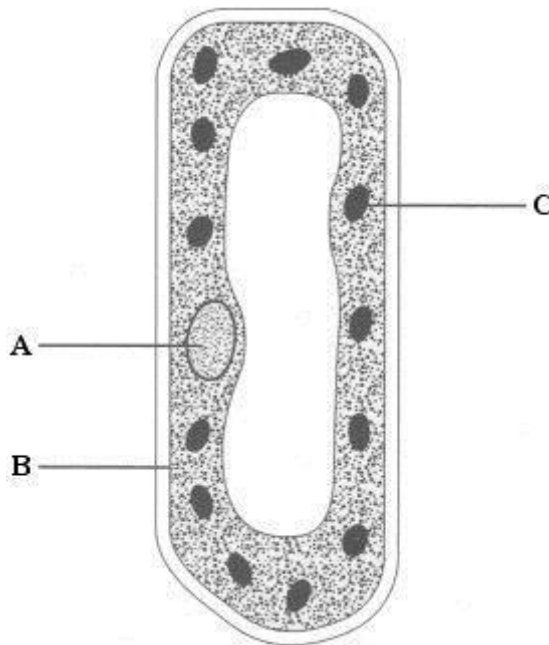
_____ (1)

- (ii) Explain the advantages of red blood cells passing through a capillary one at a time.

(3)
(Total 7 marks)

Q33.

The diagram shows a cell from a plant leaf.



(a) Name structures **A** and **B**.

A _____

B _____

(2)

(b) Structure **C** is a chloroplast. What is the function of a chloroplast?

(1)

(c) The table gives one difference between a plant cell and an animal cell.

Complete the table to give **two** more differences.

Plant cell	Animal cell
1. Has chloroplasts	1. No chloroplasts
2.	2.
3.	3.

(2)
(Total 5 marks)

Q34.

- (a) (i) Name the red pigment found in red blood cells.

_____ (1)

- (ii) Describe, in detail, the function of this red pigment.

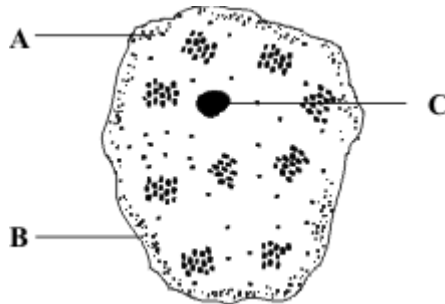
 _____ (2)

- (b) Describe **one** other way in which the structure of a red blood cell is different from the structure of a white blood cell.

 _____ (1)
 (Total 4 marks)

Q35.

The diagram shows an animal cell.



- (a) Name **each** labelled part and give its function.

A Name _____

Function _____

B Name _____

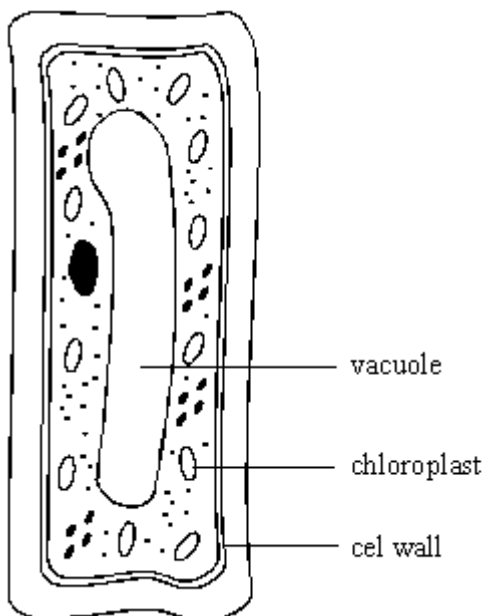
Function _____

C Name _____

Function _____

(6)

- (b) (i) This plant cell also contains chloroplasts, a cell wall and a vacuole. Label **each** of these parts on the diagram.



(3)

- (ii) Give the function of these parts of a plant cell.

Chloroplast function _____

Cell wall function _____

Vacuole function _____

(3)

(Total 12 marks)

Mark schemes

Q1.

- (a) (i) 25°C 1
- (ii) pathogens 1
- (b) **D** 1
- more / most bacteria killed
accept biggest area / ring where no bacteria are growing 1
- (c) viruses live inside cells 1
- [5]**

Q2.

- (a) **A** cytoplasm 1
in this order only
- B** (cell) membrane 1
*do **not** accept (cell) wall*
- (b) (i) synapse 1
- (ii) (as) chemical 1
accept neurotransmitter or named
ignore references to how the chemical is passed
*do **not** accept electrical*
- (c) (from light-sensitive cell to connecting neurone) to sensory neurone 1
ignore references to synapses accept 'nerve cell' for neuron(e) throughout penalise 'nerve' for neurone once only
- (sensory neurone) to brain / CNS 1
allow (sensory neurone) to relay neurone / spinal cord
- (brain / CNS) to motor neurone 1
allow (relay neurone / spinal cord) to motor neurone
- (motor neurone) to (eyelid) muscle 1
ignore effector

1
[8]

Q3.

(a) (i) A = cytoplasm

1

B = (cell) membrane

1

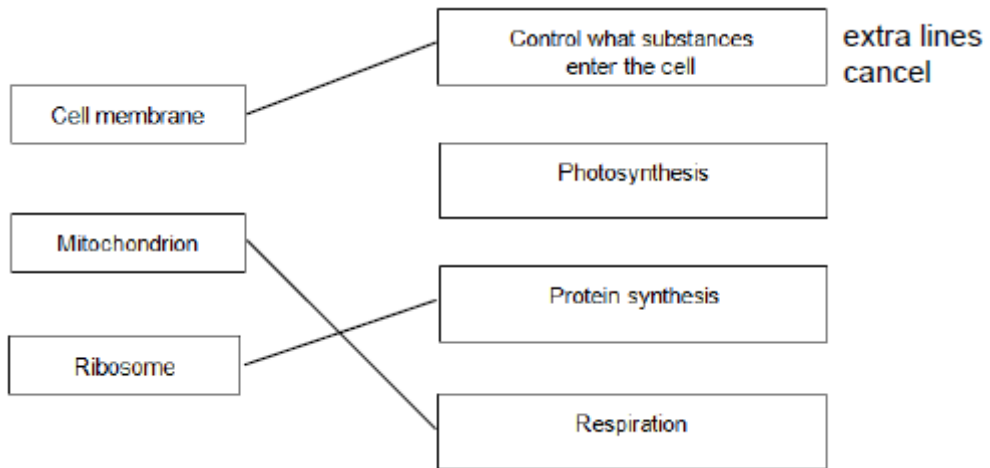
(ii) nucleus

accept chromosome / DNA / genes

accept phonetic

1

(b)



3
[6]

Q4.

(a) B

1

(b) D

1

(c) A

1

[3]

Q5.

(a) (i) (cell) membrane

1

(ii) vacuole

1

- (b) any **two** from:
- (cell) wall
 - chloroplast(s)
ignore chlorophyll
 - vacuole
ignore cell sap
- 2
- (c) diffusion
- 1
- [5]**

Q6.

- (a) (i) makes / produces / synthesises protein / enzyme
- 1
- (ii) plant cell has nucleus / vacuole / chloroplasts / chlorophyll
or plant cell is much larger
'It' = plant cell
allow correct reference to DNA or chromosomes
allow plant cell has fewer ribosomes
allow cellulose (cell wall)
- 1
- (b) (i) 200
correct answer with or without working gains 2 marks
- 2
- if answer incorrect, allow 1 mark for*
 $\frac{2 \times 50,000}{500}$
or
 $\frac{100,000}{500}$
or 100
- (ii) bacterial cell is too small / bacterial cell about same size as a mitochondrion / 'no room'
ignore references to respiration
- 1
- [5]**

Q7.

- (a) cell division / bacterium divides / multiplies / reproduces
allow asexual / mitosis
ignore growth
- 1
- (b) 18
- 1
- 18 000 / 18×10^3 / 1.8×10^4

- do **not** accept 1.8 / 1.8⁰⁴ / 1.8⁴*
allow ecf from wrong count 1
- (c) to kill / destroy other microorganisms / named type
or to prevent contamination 1
ignore germs / viruses
- to prevent other microorganisms affecting the results
or other microorganisms would be counted 1
allow to give accurate / reliable results
- (d) prevent growth of pathogens / disease-causing microorganisms / dangerous
 microorganisms 1
*do **not** accept microorganisms become pathogenic*
ignore germs / viruses
ignore general safety / biohazards / harmful products
produced by bacteria
- (e) to improve the reliability of the investigation / check for anomalies 1
*do **not** accept accuracy / precision / fairness / validity*
ignore averages / repeatability / reproducibility

[7]

Q8.

- (a) (i) diffusion is down the concentration gradient 1
for a description of diffusion
ignore along / across gradients
- to enter must go up / against the concentration gradient
accept by diffusion ions would leave the root
- or**
- concentration higher in the root / plant
- or**
- concentration lower in the soil 1
- (ii) active transport 1
allow active uptake
- (b) (i) (root hairs →) large surface / area 1
- (ii) (aerobic) respiration

do **not** allow anaerobic

1

releases / supplies / provides / gives energy
 accept make ATP (for active transport)
 do **not** allow 'makes / produces / creates' energy

1

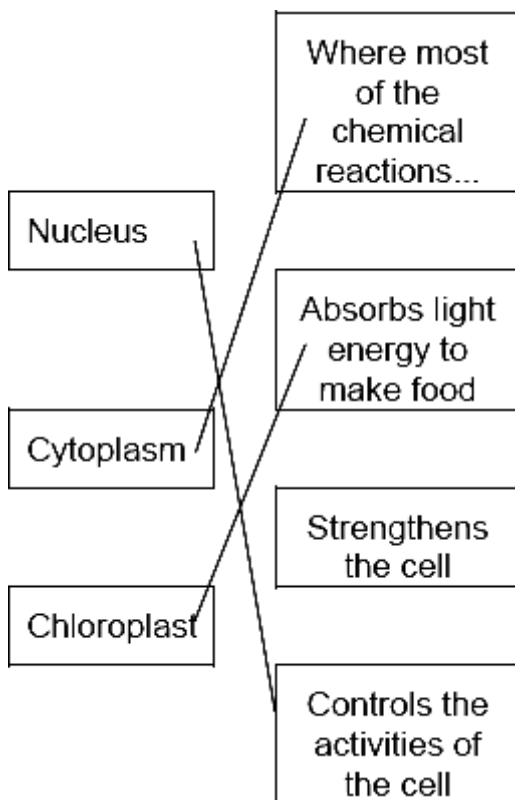
(iii) starch is energy source / store (for active transport)
 allow starch can be used in respiration
 do **not** allow 'makes / produces / creates' energy

1

[7]

Q9.

(a)



1 mark for each correct line
 mark each line from left hand box
 two lines from left hand box cancels mark for that box

3

(b) energy

1

[4]

Q10.

(a) (i) tissue

extra box ticked cancels the mark

1

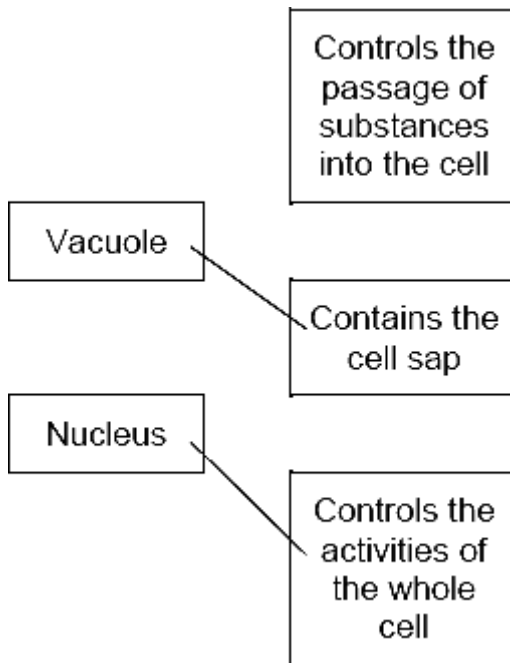
(ii) organ
extra ring drawn cancels the mark 1

(b) (i) Layer B
each extra box ticked cancels 1 mark 1

Layer C 1

(ii) (contain) chloroplasts / chlorophyll
other parts disqualify 1

(c)



two correct = 2 marks
one correct = 1 mark
extra line from a part of a cell cancels the mark

2

[7]

Q11.

(a) because water enters (the cell / it / named cell)
*do **not** accept salt / sugar / solution entering* 1

by osmosis / diffusion
if osmosis / diffusion not given accept concentration inside cell greater than outside cell
assume concentration refers to solute concentration unless answer indicates otherwise
allow water goes up the concentration gradient

allow water goes down its concentration gradient
*do **not** accept if diffusion of salt / sugar*

1

through a partially permeable membrane

*allow semi / selectively permeable membrane **or** description*

1

(b) (plant cells) have (cell) wall

accept animal cells have no (cell) wall

ignore reference to cell membrane

*do **not** accept reference to other organelles **or** any*
implication that animal cells have a cell wall eg plant cells
have a thicker cell wall

1

[4]

Q12.

(a) (i) release energy

allow provide / supply / give energy

*do **not** accept produce / create / generate / make energy*

*do **not** allow release energy for respiration*

1

(ii) contain half the (number of) chromosomes **or** contains one set of chromosomes **or** contains 23 chromosomes

allow genetic information / DNA / genes / alleles instead of chromosomes

accept haploid

1

(b) any two from:

- (stem cells) are unspecialised / undifferentiated
allow description eg 'no particular job'
- are able to become differentiated
or can form other types of cell / tissue / organ
- stem cells can / able to divide / multiply

2

[4]

Q13.

(a) (i) sex cells

1

(ii) chromosomes

1

(b) (i) two

1

- (ii) recessive 1
- (c) (i) cell membrane 1
allow membrane
- (ii) cytoplasm 1
- (d) (i) A 1
- (ii) B 1

[8]

Q14.

- (a) root 1
- (b) (i) chlorophyll 1
- (ii) absorbs / traps / takes in light 1
*do **not** accept attracts / solar energy /sunshine / sun*
- (for) photosynthesis 1
accept to make food / glucose / sugar/ biomass

Mineral ion	Effect of its shortage
Magnesium	Yellow leaves
Nitrate	Stunted growth
	White flowers

(c)

*1 mark per correct line
extra line from a mineral ion cancels the mark*

2

[6]

Q15.

- (a) (i) inoculating loop 1
- (ii) V 1
- W
either order 1
- (iii) Z 1
- (b) carbohydrates 1

[5]

Q16.

- (a) (i) C and D 1
- (ii) cell wall 1
- (b) (i) A 1
- (ii) D 1
- (c) respiration 1

[5]

Q17.

- (a) B
- no mark for ÉBÉ, alone*
- large(r) surface / area **or** large(r) membrane
accept reference to microvilli
accept reasonable descriptions of the surface
*do **not** accept wall / cell wall*
ignore villi / hairs / cilia 1
- (b) (i) any **one** from:
- insulin / hormone
if named hormone / enzyme must be correct for pancreas
 - enzyme / named enzyme 1
- (ii) many ribosomes

1

(ribosomes) produce protein

accept insulin / hormone / enzyme named is (made of) protein

or

allow many mitochondria (1)

provide energy to build protein **or** to make protein (1)

accept ATP for energy

1

[4]

Q18.

(a) (i) root hair

1

(ii) any **two** from:

ignore food

- water
- ions / minerals / nutrients / salts / correct named eg nitrates
ignore N,P,K
- oxygen

2

(b) (i) stomata

1

(ii) diffusion

1

[5]

Q19.

(a) (i) A cytoplasm

accept clear indications

1

B nucleus

1

(ii) any **two** from:

two required for **1** mark

- P
- R
- T

accept lower case letters

- 1
- (b) sperm cells need a lot of energy to swim
- 1

[4]

Q20.

- (a) any **two** from:
- sterilise / kill microorganisms
ignore 'cleaning' / 'disinfect'
ignore 'germs'
 - method of sterilisation eg apparatus / media sterilised in oven / autoclave
allow pressure cooker / boiling water
 - pass flask mouth / pipette tip / loop / test tube mouth through flame
 - work near a flame
 - minimise opening of flask / test tube **or** hold non-vertical
*allow idea of sealing / covering **or** prevent entry of air*
- 2

- (b) any **two** from:
- temperature
ignore references to time / type of bacterium
 - concentration / amount of nutrients / ions
 - type of nutrient
 - volume / amount of solution
 - amount of bacteria added
 - agitation **or** amount of oxygen
- 2

- (c) (i) 7.5
accept in range 7.4 – 7.6
- 1
- (ii) use more pH values around / close to pH 7.5 / between 7 and 8
- 1

[6]

Q21.

- (a) it has many chloroplasts.
- 1
- (b) (has) cell wall
- 1

(has) vacuole **or** large / permanent vacuole
do not allow chloroplasts
assume plant cell throughout
accept converse for animal cell

1

[3]

Q22.

(a) A

1

(b) (i) diffusion

1

(ii) respiration

1

(iii) mitochondria

1

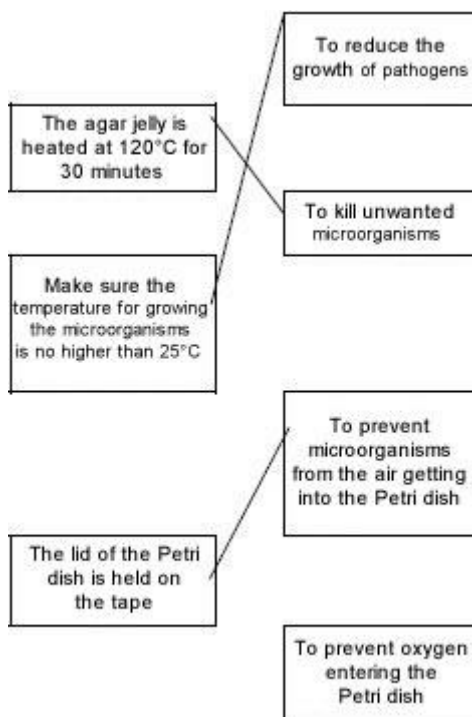
(iv) photosynthesis

1

[5]

Q23.

(a) **List A – Action** **List B – Effect**



1 mark per correct line
each extra line cancels 1 mark

3

- (b) (i) dish 2 has (colonies of) microorganisms / bacteria / (but there are none in dish 1)
allow fungi / pathogens / microbes / germs
allow more microorganisms in dish 2 1
- (ii) untreated milk contains living microorganisms
or
 microorganisms killed by UHT
or
 no living microorganisms in UHT milk
ignore microorganisms enter from the air 1
- (iii) dish 3 was not opened
*do **not** allow no growth of microorganisms because of lack of air / oxygen*
or
 it was sterilised
ignore microorganisms cannot enter from the air
or
 nothing / no milk was added 1

[6]

Q24.

- (a) **A** nucleus 1
- B** (cell) membrane 1
- C** cytoplasm 1
- (b) any **two** from:
- (contain mitochondria)
 - many (mitochondria)
 - respiration (occurs in mitochondria)
- 2

[5]

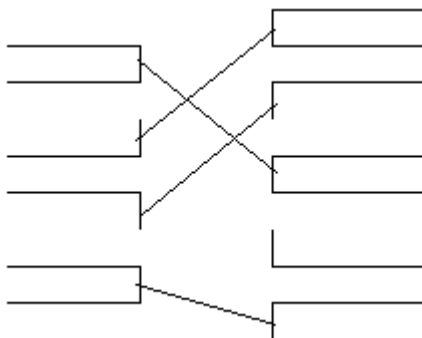
Q25.

- (a) root hair 1
- (b) (i) 85 1
if incorrect unit added = 0
- (ii) 0.85 2
ignore working or lack of working
accept correct answer from candidate's (i) for 2 marks

$$\frac{85}{100}$$
with no answer or wrong answer gains 1 mark
accept ecf
- (iii) absorb more water / ions 2
allow 'get / collect / take in / take up / soak up / suck up' for absorb
allow 'lots' for more
allow 'moisture' for water
allow 'minerals / salts / nutrients' for ions
*do **not** allow food or named foods*
absorb water / ions gains 1 mark
- or**
- large surface area to absorb water / ions (2) 2
large surface area linked to incorrect function = 1
ignore small so short diffusion pathway

[6]

Q26.



1 mark for each line
extra line from List A Action cancels the mark

[4]

Q27.

- (a) any **two** from:
- amylase / carbohydrase
 - protease
allow trypsin
 - lipase
- 2
- (b) (i) high / above normal blood sugar
or cannot control blood sugar
allow other symptoms
*eg frequent / plentiful urination **or** sugar in urine **or** thirst **or** weight loss **or** coma*
ignore consequential effects eg blood pressure / circulation / glaucoma / tiredness
- 1
- (ii) any **one** from:
- small / regular meals
 - low sugar (meals) or low GI / GL **or** carbohydrates as starch
allow high fibre
ignore reference to low carbohydrate
- 1
- (iii) any **one** from:
- keep constant(blood) sugar **or** prevent high (blood) sugar
or reduces surge / rush of sugar into blood
 - reduce the need for insulin
- 1
- (iv) (take) insulin
allow pancreas transplant
- 1
- (c) protein / hormone / enzyme synthesis **or** synthesis of named example
or combine amino acids
- 1

[7]

Q28.

- (a) any **two** from:
- transport up / against concentration gradient / low to high concentration
 - uses energy
 - use of protein / carrier

- | | | |
|--|---|--|
| | 2 | |
| (b) microvilli – large(r) surface area
<i>accept have carriers</i> | 1 | |
| mitochondria – release energy or make ATP
<i>do not accept 'makes energy'</i> | 1 | |

[4]

Q29.

- | | | |
|--------------------------|---|--|
| (a) A nucleus | 1 | |
| B (cell) membrane | 1 | |
| C cytoplasm | 1 | |
| (b) (i) it is thin | 1 | |
| (ii) diffusion | 1 | |

[5]

Q30.

- | | | |
|---|---|--|
| (a) (i) red cell | 1 | |
| (ii) diffusion | 1 | |
| (iii) haemoglobin | 1 | |
| (iv) a nucleus | 1 | |
| (b) (<u>on diagram</u>) arrow from any part of blood to air | 1 | |

[5]

Q31.

- | | | |
|-----------------------------------|---|--|
| (a) (i) A = nucleus | 1 | |
| B = (cell) <u>membrane</u> | 1 | |

- (ii) (cell) membrane 1
- (b) 70
- if correct answer, ignore working or lack of working*
- $$\frac{63+78+69}{3}$$
- for 1 mark* 2
- [5]

Q32.

- (a) hold cells together **or** prevent flow of cells **or** trap cells 1
- (b) 12500
- if correct answer, ignore working / lack of working*
- $$\frac{100}{0.008}$$
- for 1 mark*
- ignore any units* 2
- (c) (i) size RBC approximately same size capillary **or**
no room for more than one cell **or**
only one can fit **or**
RBC is too big
allow use of numbers
*do **not** accept capillaries are narrow* 1
- (ii) more oxygen released (to tissues) **or**
more oxygen taken up (from lungs) 1
- and any **two** from:
- slows flow **or** more time available
 - shorter distance (for exchange) **or** close to cells / capillary wall
 - more surface area exposed 2
- [7]

Q33.

- (a) **A** = nucleus
accept phonetic spelling only 1
- B** = (cell) membrane
accept plasma membrane

1

(b) any **one** from:

photosynthesis

makes sugar / starch / carbohydrate / organic material

accept 'makes food'

*do **not** accept makes chlorophyll*

ignore stores starch / food / light / chlorophyll

traps or absorbs light

1

(c) any **two** from:

Plant cell

Animal cell

• (has) vacuole **or** has cell sap

• no vacuole **or** small/temporary vacuole **or** no cell sap

• (has) wall/cellulose

• no wall/cellulose **or** only membrane

• (stores) starch **or** doesn't store glycogen

• doesn't store/have starch **or** stores glycogen

ignore reference to shape

must be clear indication in all four boxes

ignore reference to chlorophyll

2

[5]

Q34.

(a) (i) haemoglobin / oxyhaemoglobin

must be phonetic

1

(ii) carries oxygen **or** forms oxyhaemoglobin

Ignore references to CO₂ / iron

cancel if extras like food / glucose

1

from lungs to tissues

1

(b) no nucleus **or** biconcave disc (described)

ignore references to size

ignore vague references to being

'round' / 'donut' shaped etc.

1

[4]

Q35.

- (a) A cytoplasm 1
- where (chemical) reactions take place
do not accept where cell functions take place 1
- or**
- carries/holds the organelles/named organelles / named chemicals (including nutrients)
do not accept keeps the shape of the cell
- or**
- contains water
- or**
- presses out on the membrane
allow: keeps cell turgid
allows transport through the cell
- B membrane 1
- do not accept by themselves:*
protects cell
gives shape
- controls what enters/leaves the cell 1
- or**
- contains the cell/holds the cell together
do not accept keeps harmful substances out
- or**
- allows movement into and out of the cell C nucleus 1
- contains the genetic material/DNA/genes/chromosomes
do not accept:
brain of the cell
stores information/instructions
tells cell what to do
- or**
- controls (the activity) of the cell 1
- (b) (i) one mark for each correctly labelled part
- cell wall*
do not accept anything inboard of the inner edge vacuole
accept anything inboard of transplast
- chloroplast: site of photosynthesis/ for photosynthesis

- accept word equation **or** balanced equation* 1
- cell wall: supports the cell/keeps the shape/keeps it rigid
*do **not** accept protects the cells* 2
- (ii) vacuole: acts as reservoir for water / chemicals/(cell)/sap 3
- or**
keeps cell turgid/pushes content to edge
or
maintains concentration gradient
or
allows cell elongation (not growth) 1

[12]

Q1.

The following are precautions taken when preparing a streak of bacteria on an agar jelly plate.

Give a reason for each.

- (i) The inoculating loop is heated in a hot bunsen flame.

REASON:

(1)

- (ii) The loop is allowed to cool before putting it into the bacterial culture.

REASON:

(1)

- (iii) The lid of the petri dish is only partly opened.

REASON:

(1)

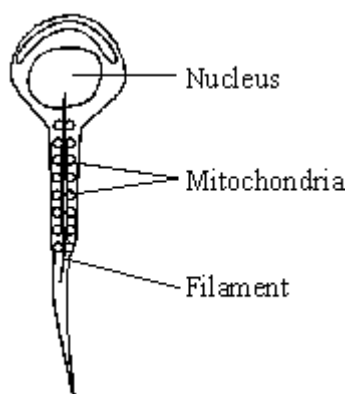
- (iv) The petri dish is sealed with sticky tape.

REASON:

(1)
(Total 4 marks)

Q2.

The diagram shows a human sperm. Inside the tail of the sperm is a filament mechanism that causes the side to side movement of the tail, which moves the sperm.



- (a) Describe the function of the mitochondria and suggest a reason why they are arranged around the filament near the tail of the sperm.

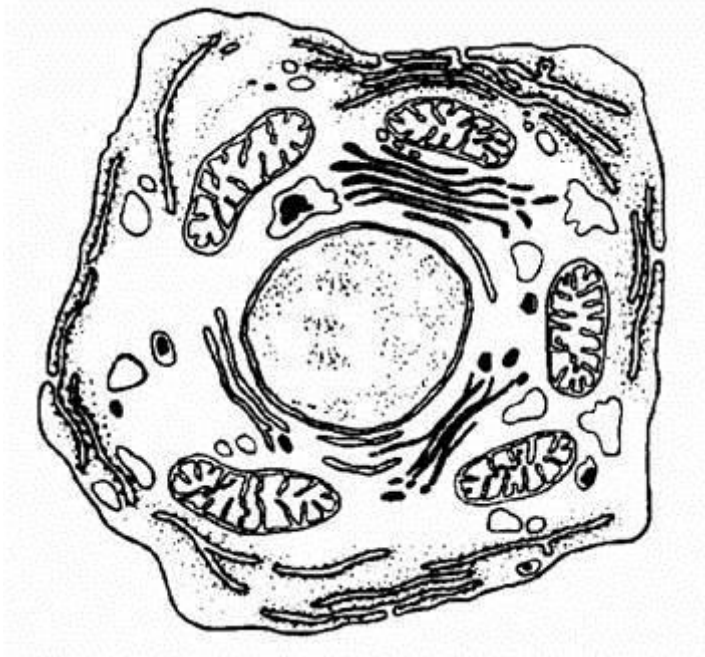
(3)

- (b) Explain the significance of the nucleus in determining the characteristics of the offspring.

(2)
(Total 5 marks)

Q3.

The drawing shows an animal cell, seen at a very high magnification using an electron microscope.



- (a) (i) Label a mitochondrion [plural = mitochondria]. (1)
- (ii) What happens in the mitochondria?
 _____ (1)
- (b) (i) Name and label the structure where you would find chromosomes. (1)
- (ii) What are chromosomes made of?
 _____ (1)
- (c) What controls the rate of chemical reactions in the cytoplasm?
 _____ (1)
- (Total 5 marks)**

Q4.

- (a) Put a tick (✓) in the correct boxes in the table below to show which of the parts given are present in the cells and organisms listed.

	CYTOPLASM	NUCLEUS	CELL WALL	GENES
Leaf mesophyll cell				
Sperm				

(2)

(b) (i) What is the main job of a leaf mesophyll cell?

(1)

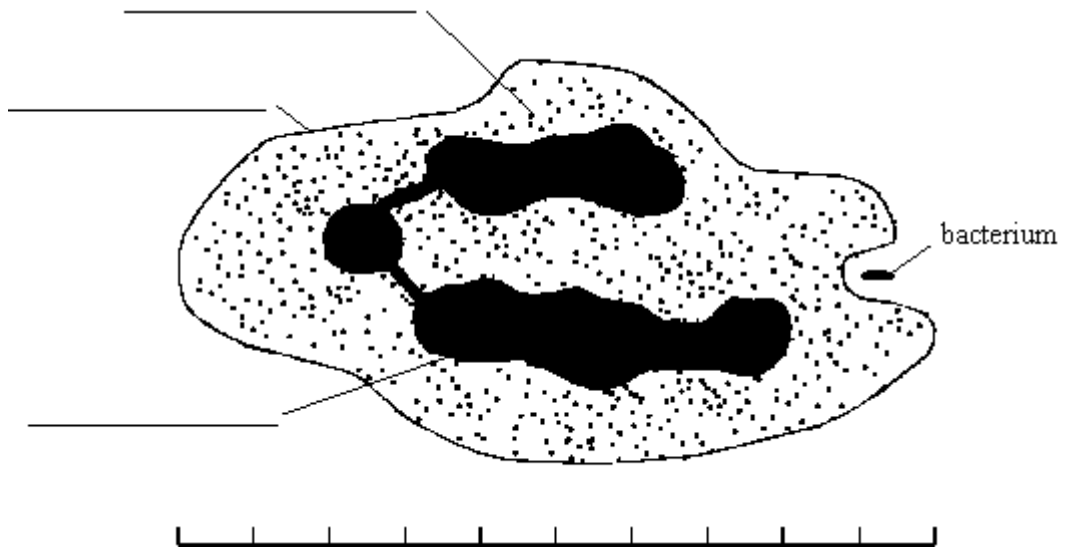
(ii) Explain **one** way in which the structure of the leaf mesophyll cell helps it to carry out its job.

(2)

(Total 5 marks)

Q5.

The drawing shows a white blood cell ingesting a bacterium.



(i) Use words from the list to label the parts of the white blood cell.

cell membrane cell wall cytoplasm nucleus vacuole

(3)

(ii) The scale shows that the white blood cell is 10 micrometres long.

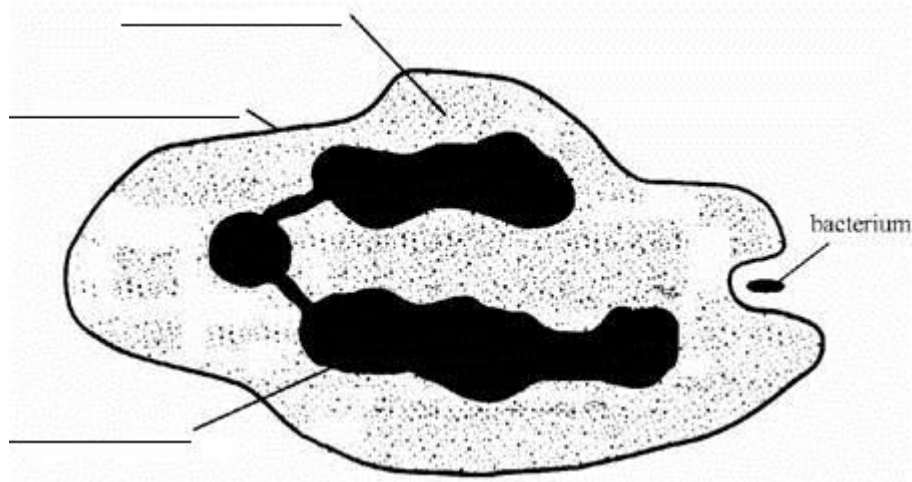
How long is the bacterium? Show your working.

_____ micrometres

(2)
(Total 5 marks)

Q6.

The drawing shows a white blood cell ingesting a bacterium.

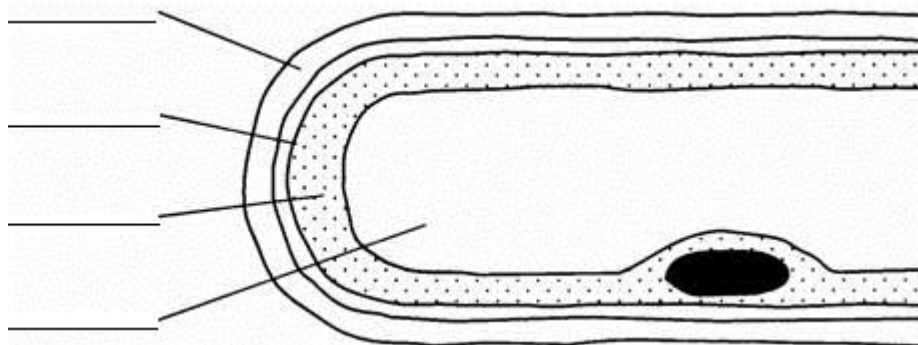


Label the parts of the white blood cell.

(Total 3 marks)

Q7.

The drawing shows part of a root hair cell.

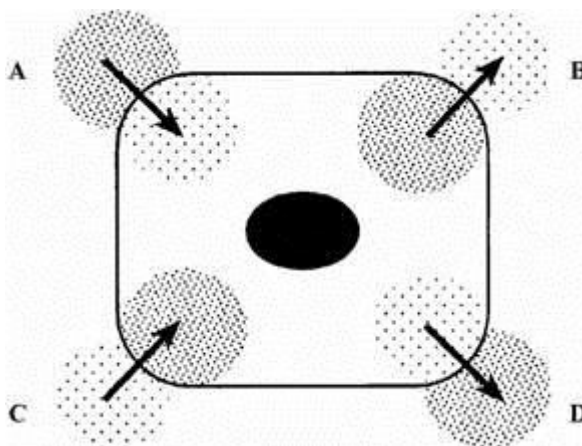


(a) Use words from the list to label the parts of the root hair cell.

cell membrane cell wall cytoplasm nucleus vacuole

(4)

(b) The diagram shows four ways in which molecules may move into and out of a cell. The dots show the concentration of molecules.



The cell is respiring aerobically.
Which arrow, **A**, **B**, **C** or **D** represents:

- (i) movement of oxygen molecules; _____
- (ii) movement of carbon dioxide molecules? _____

(2)

- (c) Name the process by which these gases move into and out of the cell.

(1)

(Total 7 marks)

Q8.

- (a) Balance the following equation for photosynthesis.



(1)

- (b) Give **two** conditions necessary for photosynthesis apart from a suitable temperature range and the availability of water and carbon dioxide.

1. _____

2. _____

(2)

- (a) Plants have leaves which contain guard cells and palisade cells. Explain how **each** of these kinds of cell assists photosynthesis.

Guard cells _____

(2)

Palisade cells _____

(2)

(d) Glucose is a product of photosynthesis. Give **three** uses which green plants make of glucose.

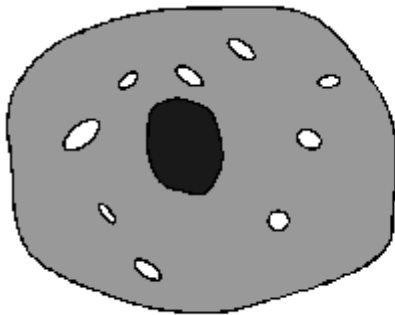
1. _____
2. _____
3. _____

(3)

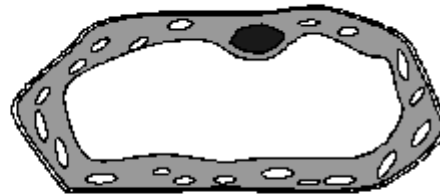
(Total 10 marks)

Q9.

The diagrams show a cheek cell from a human and a leaf cell from a plant.



Cheek cell



Leaf cell

(a) The two cells have a number of parts in common.

(i) On the cheek cell, label **three** of these parts which both cells have.

(3)

(ii) In the table, write the names of the **three** parts you have labelled above and describe the main function of each part.

Part	Function

(3)

- (b) Blood contains white cells and red cells. State the function of each type of cell in the blood.

White cells _____

Red cells _____

(2)

(Total 8 marks)

Q10.

Oxygen from our lungs is carried, by our blood, to cells in our body where aerobic respiration takes place.

- (i) Complete the **two** spaces to balance the chemical reaction for aerobic respiration.



(1)

- (ii) Name the substance with the formula $\text{C}_6\text{H}_{12}\text{O}_6$.

(1)

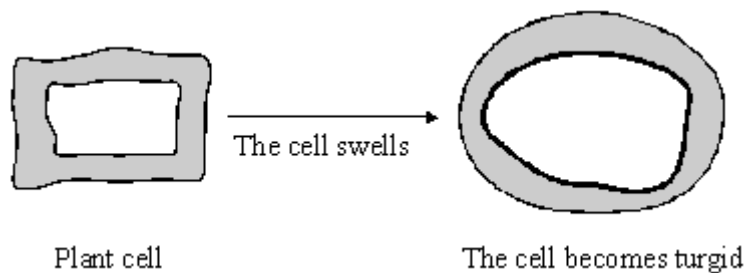
- (iii) Name the structures in the cytoplasm of our cells where aerobic respiration takes place.

(1)

(Total 3 marks)

Q11.

- (a) The diagrams show what happens to the shape of a plant cell placed in distilled water.



- (i) Explain why the cell swells and becomes turgid. Name the process involved.

(2)

(ii) Give **one** feature of the cell wall which allows the cell to become turgid.

(1)

(b) Describe the change which will occur if a piece of peeled potato is placed in a concentrated sugar solution and explain why this change occurs.

(3)

(Total 6 marks)

Q12.

(a) How many pairs of chromosomes are there in a body cell of a human baby?

(1)

(b) Place the following in order of size, **starting with the smallest**, by writing numbers **1 – 4** in the boxes underneath the words.

chromosome

nucleus

gene

cell

(1)

(c) For a baby to grow, its cells must develop in a number of ways.

Explain how each of the following is part of the growth process of a baby.

(i) Cell enlargement

(1)

(ii) The process of cell division by mitosis

(3)

- (d) Why is cell specialisation (differentiation) important for the development and growth of a healthy baby from a fertilised egg?

(2)

(Total 8 marks)

Mark schemes

Q1.

- (i) the loop is sterilised
accept to kill anything on the loop
- or**
to kill any bacteria on it;
do not credit to clean the loop
- 1
- (ii) if hot it would kill bacteria picked up (from culture);
accept 'microorganisms' or 'microbes'
accept entry of contaminated air but reject entry of air unqualified
- 1
- (iii) to prevent entry (from the air) of unwanted bacteria or bacterial spores or fungal spores;
accept so can't breath on it
accept 'microorganisms' or 'microbes'
- 1
- (iv) so that the (petri) dish is not opened (after bacteria are cultured)
or to reduce evaporation
or drying of the agar,
accept 'microorganisms' or 'microbes'
accept to prevent anything relevant getting in/out
reject references to spillage
- 1

[4]

Q2.

- (a) **award one mark for each key idea**
- energy released **or** energy transferred **or** respiration
*allow provides **or** gives*
*do **not** allow produces **or** makes*
- 3
- near to the site of movement **or**
energy available quickly **or** more energy
accept allows more mitochondria to fit in
- (mitochondria) packed (around filament) **or** efficient arrangement **or** spiral arrangement
- (b) contains chromosomes **or** genes **or**

DNA

not genetic material

1

(which) contribute half (the genes) to the fetus **or** offspring

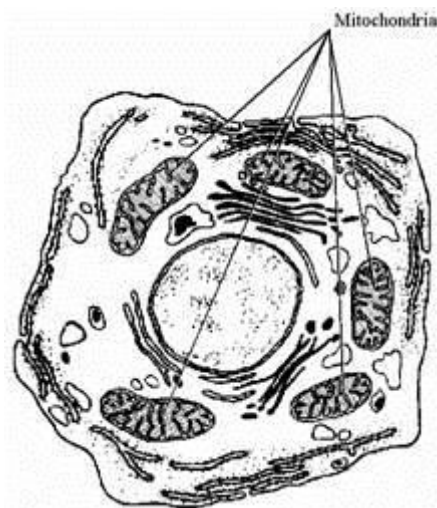
*23 chromosomes or half the genes
 or reference to X, Y chromosome determining sex (if the notion of halfness is there)
 nucleus contains half genes for the offspring = 2 marks*

1

[5]

Q3.

(a) (i)



award 1 mark for any of the mitochondria correctly labelled if a number are labelled and one is incorrect award 0 marks

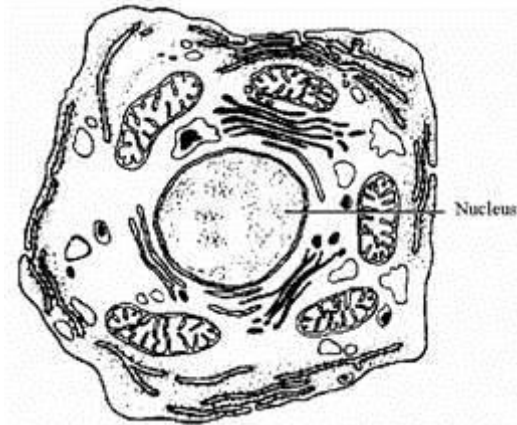
1

(ii) respiration **or** the release **or** transfer of energy **or** it contains the enzymes for respiration

do not accept energy produced

1

(b) (i) nucleus (named and correctly labelled)



arrow or line must touch or go inside the nuclear membrane

1

(ii) DNA or genes or nucleic acids

accept protein or histones or nucleotides or ATGC

1

(c) enzymes or nucleus

*do not accept factors that affect the rate rather than control it
eg pH or temperature*

1

[5]

Q4.

(a) mesophyll / / / / (all correct) sperm // x / (all correct)

for 1 mark each

2

(b) (i) absorbs light/to produce food/photosynthesis

(allow references to gaseous exchange)

for 1 mark

1

(ii) has chlorophyll/chloroplasts to absorb light/produce food

for 1 mark each

*(if linked to gas exchange allow – moist surface/
dissolve gases)*

2

[5]

Q5.

(i) cytoplasm
(cell) membrane
nucleus

*all correctly labelled
each for 1 mark*

3

(ii) 0.5

*gains 2 marks
(5/100 × 10 or ½ /1 gains 1 mark if 0.5 not given)*

2

[5]

Q6.

cytoplasm reject protoplasm
(cell) membrane
nucleus

*all correctly labelled
each for 1 mark*

[3]

Q7.

(a) (cell) wall
(cell) membrane
cytoplasm
vacuole

for 1 mark each

4

(b) (i) A
(ii) B

for 1 mark each

2

(c) diffusion (reject osmosis)
for 1 mark

1

[7]

Q8.

(a) 6 6 6

*all required
accept a '6n 6 n n 6n' version of the balanced equation
provided it is correct in every detail*

1

(b) any **two** of

- (presence of) chlorophyll **or** (amount of) chloroplasts
accept green leaves (or other green parts)
- (sufficient) light (intensity)
- (light) of **a** suitable wavelength
*any light other than green light
do not credit Sun's energy or sunshine or Sun*

2

(c) **guard cells**

any **two** of

- * control by osmosis
- * the movement of gases

*accept movement of carbon dioxide **or** oxygen **or** water vapour beware movement of CO₂ out accept a diagram or description*

- * through the stoma

2

palisade cells

any **two** of

- * near the upper surface
- * contain (a great) many **or** more chloroplasts
- * (so) contain the most chlorophyll

2

(d) any three of

- * for respiration
- * conversion to (insoluble) starch

or to food store **or** to (other) carbohydrates

- * (conversion to) sucrose **or** to food store **or** to (other) carbohydrates

or polysaccharides

*do not credit just to grow **or** live*

***or** survive*

accept conversion to food store

***or** to (other) carbohydrates once only*

- * (conversion to) lipids **or** fats **or** oils

- * (conversion to) amino acids **or** (plant) proteins **or** auxins **or** (plant) hormones **or** enzymes

3

[10]

Q9.

- (a) (i) the three features correctly labelled on cheek cell (which are referred to in part (ii))

label lines should touch or end very close to part no marks if leaf cell labelled

nucleus

cytoplasm

cell membrane

mitochondrion

accept mitochondria or one of these could be labelled vacuole

3

(ii) any **three** from

feature

function

nucleus

controls cell

accept contains genetic material or genes or chromosomes or stores information do not credit the brain of the cell

cytoplasm occurs

where respiration

accept contains food or mitochondria

or reactions occurs

membrane chemicals

less water **or**

accept surrounds the cell or lets some things in but not others

do not credit keeps things out or protection

in and **or** out

mitochondria

where energy released

ecf from leaf cell labelling

accept chloroplasts make sugar or glucose

accept vacuole contains sap

accept if cell wall mis labelled on cheek cell, support or hold together

3

(b) fight **or** ingest **or** kill bacteria **or** germs **or** viruses **or** microbes

accept produce antitoxins or antibodies fight disease (organisms)

do not credit fungus

1

(transport) oxygen **or** carry haemoglobin

accept transport carbon dioxide or helps form scabs

1

[8]

Q10.

(i) 6 in both spaces

do not credit if any formula has been altered

1

(ii) glucose
*allow fructose **or** dextrose* 1

(iii) mitochondria
accept organelles 1

[3]

Q11.

(a) (i) water (molecules) enter(s) (the cell)
***or** water (molecules) pass(es) through the (semi-permeable) cell membrane* 1

by osmosis
***or** because the concentration of water is greater outside (the cell than inside it the vacuole)*
accept because of the concentration gradient provided there is no contradiction 1

(ii) any **one** from

(it is) elastic

(it is) strong

(it is fully) permeable (to water)
***or** water can pass through it*
do not credit semi-permeable
do not credit cell membrane is semi-permeable 1

(b) (the piece of) potato shrinks
***or** loses its turgor*
***or** becomes flabby*
***or** becomes flaccid*
***or** plasmolysis occur*
***or** cytoplasm pulls away from the cell wall*

(because) concentration of sugar
***or** because concentration of water* 1

(solution) is greater than concentration inside the cell / vacuole
inside the cell / vacuole is greater than concentration (of water) outside 1

water is drawn out of the cell

1

[6]

Q12.

- (a) 23 1
- (b) chromosome nucleus gene cell
 2 3 1 4 1
- (c) (i) any **one** from 1
 (cells which are bigger) take up more space
 (cells) have to get bigger **or** mature to divide
- (ii) chromosomes duplicate **or** 1
 make exact copies of self
 accept forms pairs of chromatids
- nuclei divide 1
 accept chromatids or
 chromosomes separate
- identical (daughter) cells formed 1
 accept for example, skin cells make
 more skin cells or cells are clones
- (d) any **two** from 1
- Differentiation mark*
 babies need **or** are made of different types of cells **or** cells that have
 different functions
 accept different cells are needed
 for different organs
- Division or specialisation mark*
 as fertilised egg starts to divide each cell specialises to form a part of the body
 accept specialised cells make
 different parts of the body
- Growth mark*
 specialised cells undergo mitosis to grow further cells
 accept cells divide or reproduce
 to form identical cells 2

[8]