



Cell Biology
Foundation / Higher

Name: _____

Class: _____

Date: _____

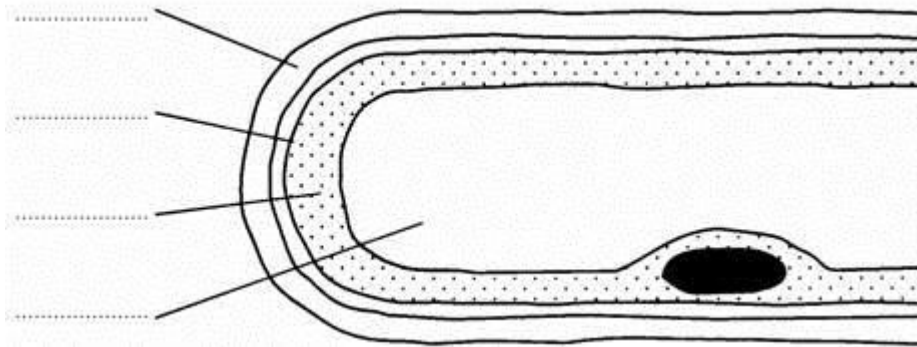
Time: **267 minutes**

Marks: **266 marks**

Comments:

Q1.

The drawing shows part of a root hair cell.

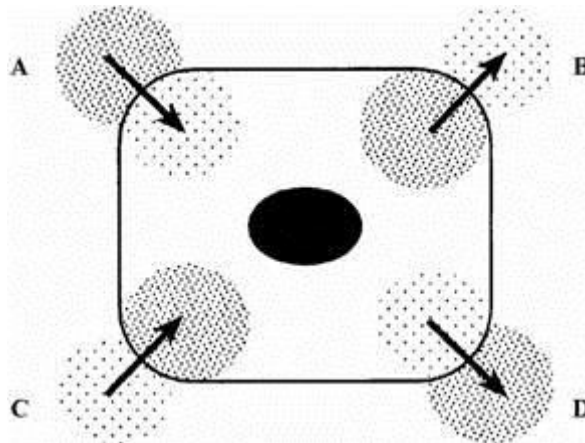


(a) Use words from the list to label the parts of the root hair cell.

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)

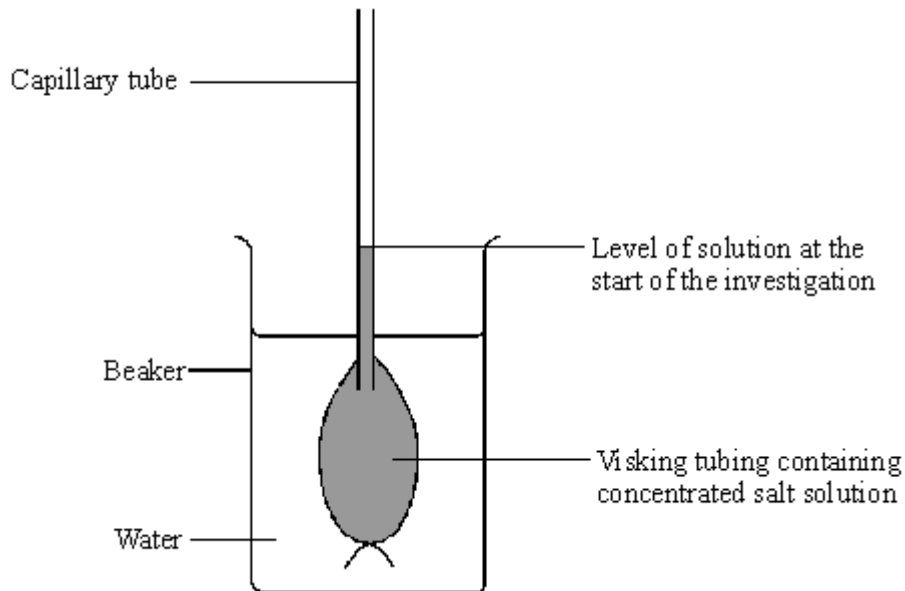
(c) Name the process by which these gases move into and out of the cell.

(1)

(Total 7 marks)

Q2.

Some students set up the equipment below to investigate osmosis.



(a) What is osmosis?

(3)

(b) (i) What will happen to the water level in the capillary tube during the investigation because of osmosis?

(1)

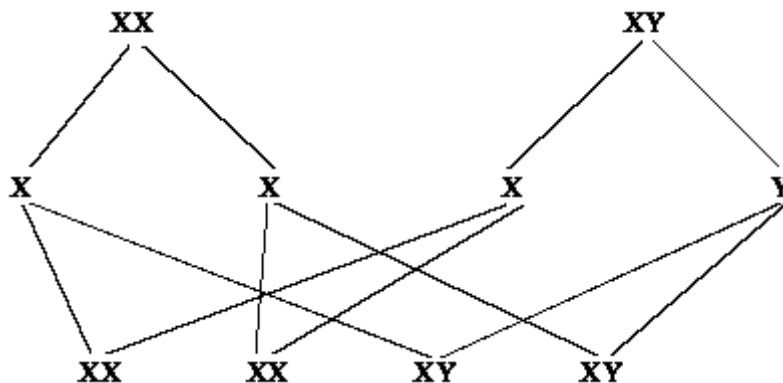
(ii) Use your knowledge of osmosis to explain why this happens.

(2)

(Total 6 marks)

Q3.

The genetic diagram shows how the chromosomes divide and combine in human reproduction.



(a) Draw circles around the symbols for the **two** male gametes.

(2)

(b) State the chance of a child being a girl.

_____ (1)

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

_____ (1)

(ii) How many chromosomes are there in a human egg cell?

_____ (1)

(d) Chromosomes contain genes. From what substance are genes made?

_____ (1)

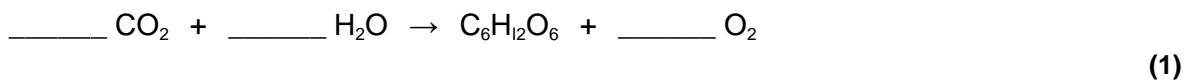
(e) In the process of mitosis, how do the number of chromosomes in the daughter cells compare to that in the original cell?

_____ (1)

(Total 7 marks)

Q4.

(a) Balance the following equation for photosynthesis.



(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)

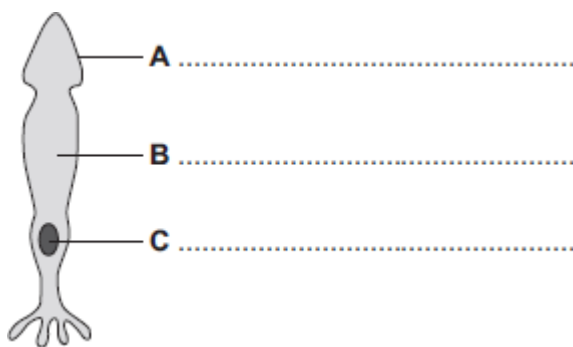
(d) Glucose is a product of photosynthesis. Give **three** uses which green plants make of glucose.

1. _____
2. _____
3. _____

(3)
(Total 10 marks)

Q5.

(a) The diagram shows a light receptor cell.



Label structures **A**, **B** and **C** on the diagram.

(3)

(b) It is important that the nervous system can detect stimuli.

Give **two** reasons why.

- _____
- _____
- _____
- _____

(2)
(Total 5 marks)

Q6.

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 $C_6H_{12}O_6$.

(1)

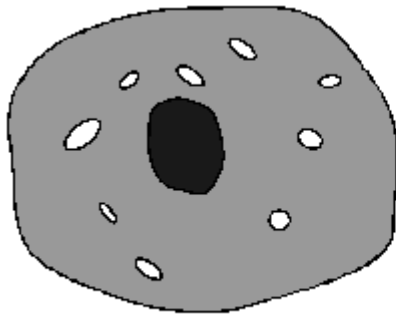
- (iii) Name the structures in the cytoplasm of our cells where aerobic respiration takes place.

(1)

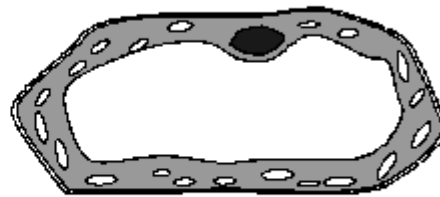
(Total 3 marks)

Q7.

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 _____

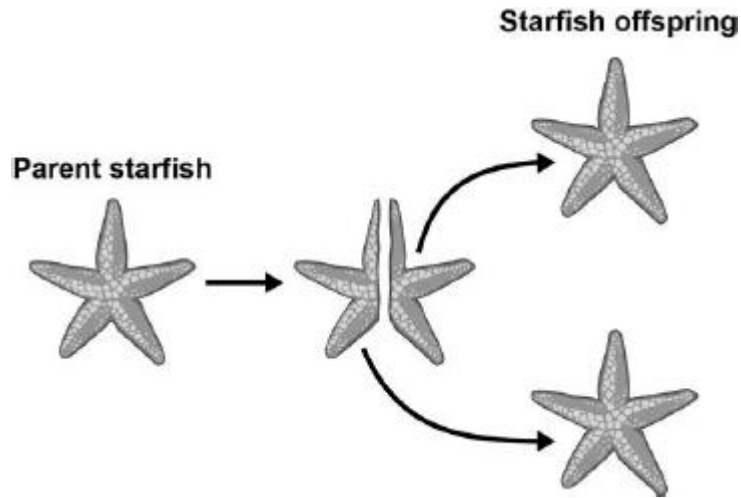
(2)

(Total 8 marks)

Q8.

Starfish can split in half. Each half can then grow new arms to form offspring.

This process is shown in the figure below.



(a) What process produces the starfish offspring?

Tick **one** box.

Asexual reproduction

Fertilisation

Selective breeding

Sexual reproduction

(1)

(b) More cells are produced as the starfish grows more arms.

What process will produce more cells in the starfish as they grow?

(1)

(c) All the offspring produced are genetically identical.

What name is given to genetically identical organisms?

(1)

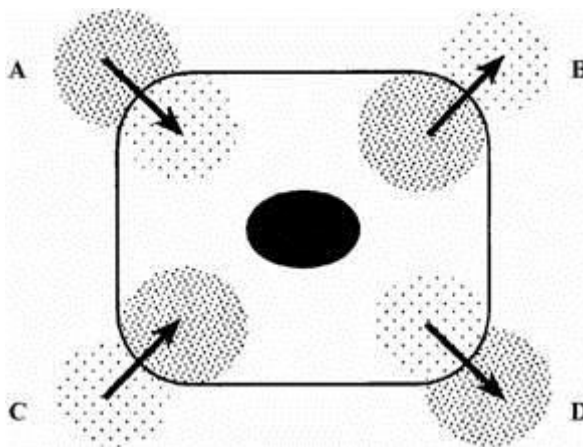
(d) Each body cell of the parent starfish contains 44 chromosomes.

How many chromosomes are in each body cell of the offspring?

(1)

Q9.

- (a) 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)

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

(1)

- (c) Which arrow, **A**, **B**, **C** or **D**, represents the active uptake of sugar molecules by the cell?

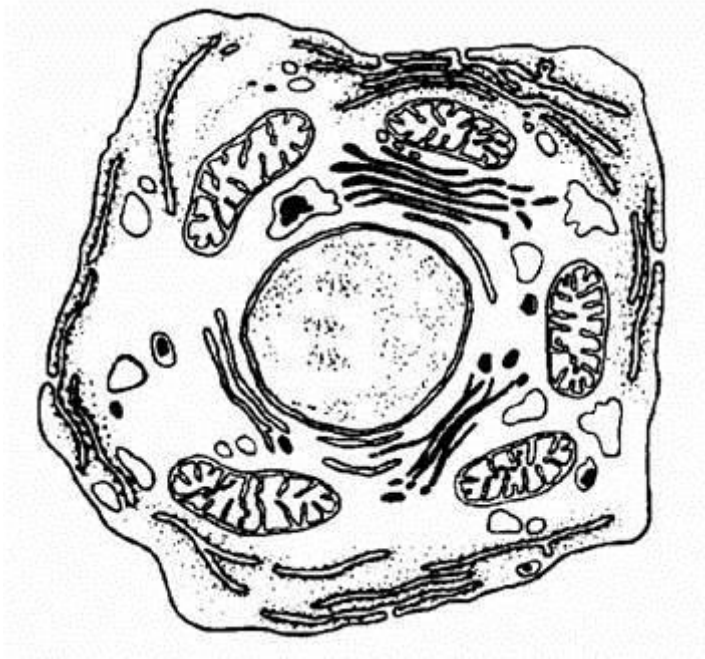
Explain the reason for your answer.

(2)

(Total 5 marks)

Q10.

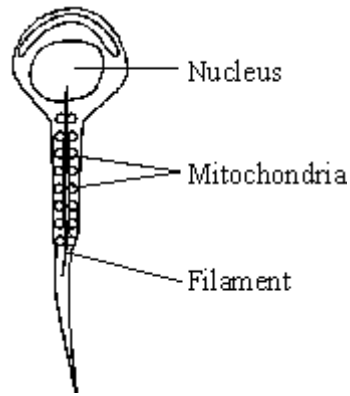
The drawing shows an animal cell, seen at a very high magnification using an electron microscope.



- (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)
- (1)
(Total 5 marks)

Q11.

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)

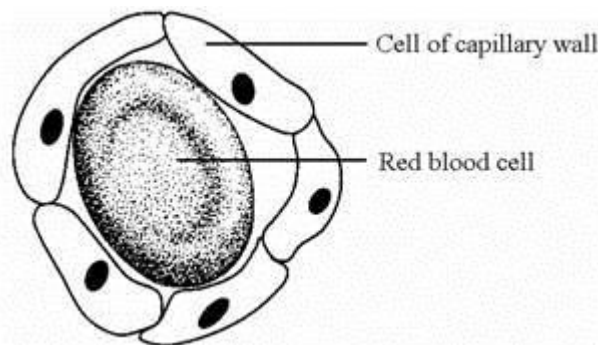
- (b) Explain the significance of the nucleus in determining the characteristics of the offspring.

(2)

(Total 5 marks)

Q12.

Capillaries are blood vessels in the body which join the arteries to the veins. They have walls which are one cell thick and so are able to exchange substances with the body cells.



- (i) Name **two** substances that travel from the muscle cells to the blood in the capillaries.

1. _____

2. _____

(2)

- (ii) Glucose is one substance that travels from the blood in the capillaries to the body cells. Explain how this happens.

(2)

(Total 4 marks)

Q13.

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

(1)

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

(2)

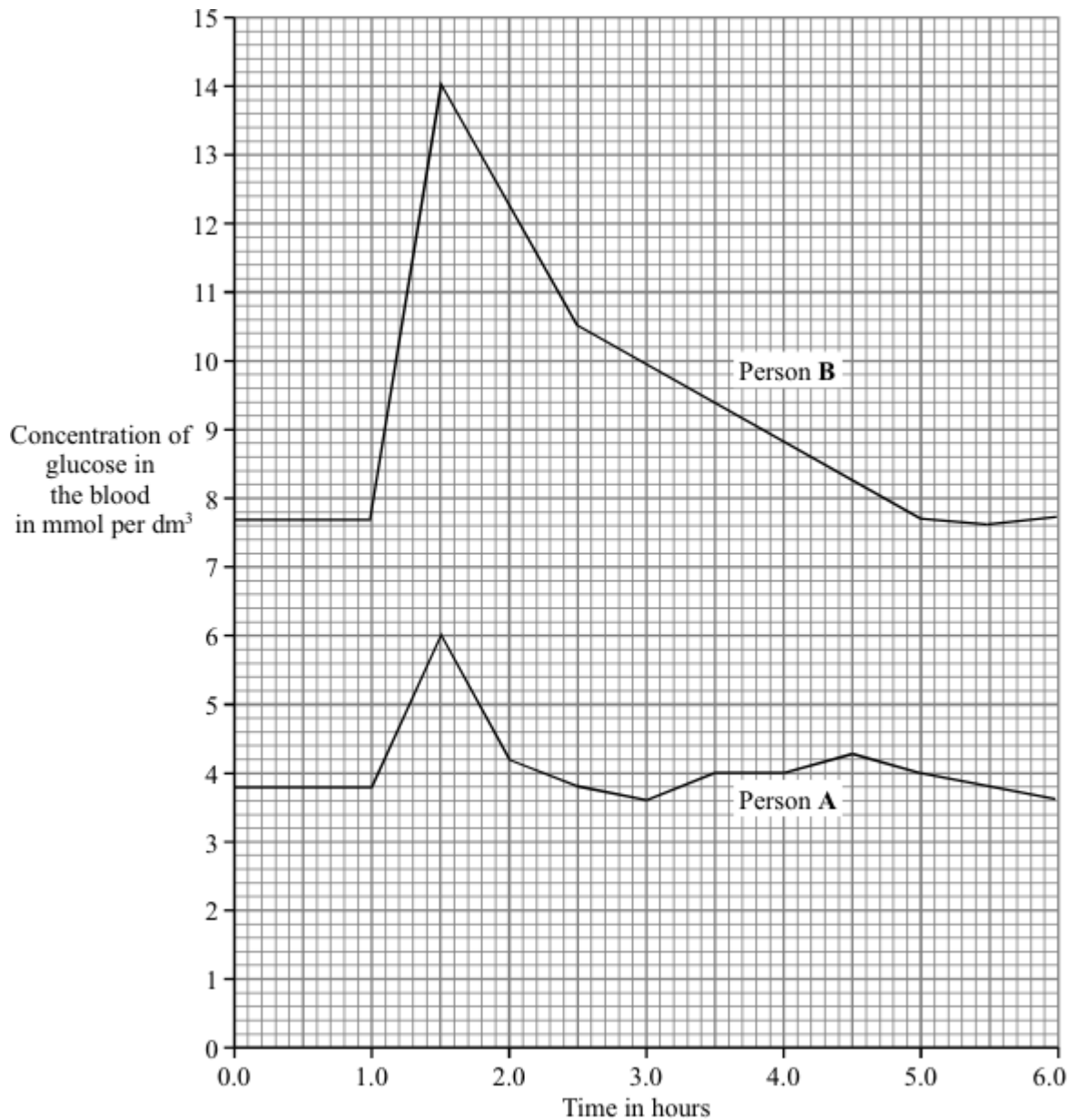
- (b) Describe **one** other way in which the structure of a red blood cell is different from the structure of a white blood cell.

(1)

(Total 4 marks)

Q14.

The graph shows the concentration of glucose in the blood of two people. Person **A** is a non-diabetic. Person **B** has diabetes. Each person ate 75 grams of glucose at 1.0 hours.



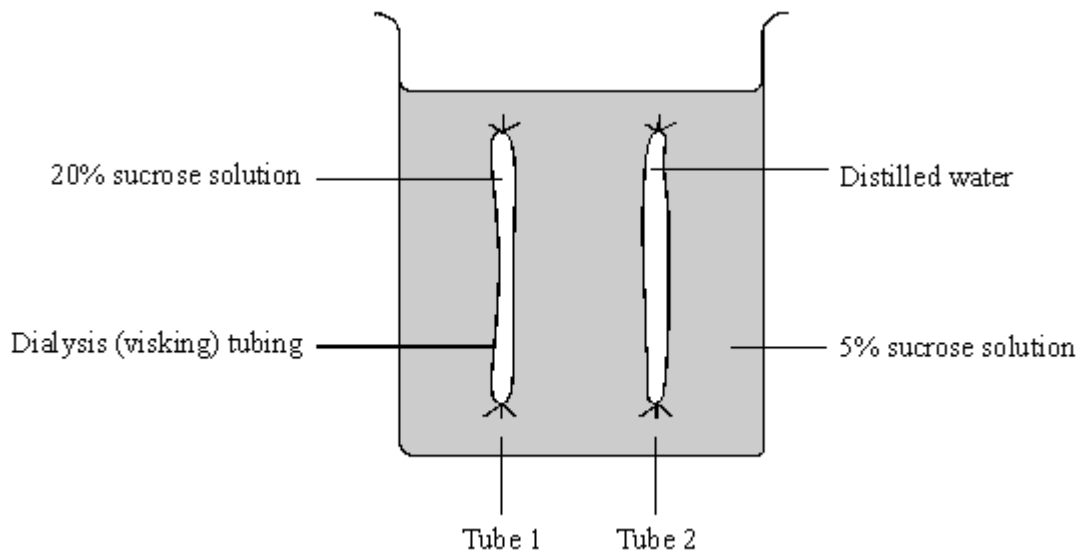
- (a) (i) What was the maximum concentration of glucose in the blood of Person **A**?
 _____ mmol per dm³ (1)
- (ii) After eating the glucose, how long did it take for the concentration of glucose in the blood of Person **B** to return to normal?
 _____ hours (1)
- (b) A diabetic person does not produce enough insulin.
- (i) Which organ produces insulin?
 _____ (1)
- (ii) Write the letter **X** on the graph to show one time when the blood of Person **A** would contain large amounts of insulin. (1)

- (c) A high concentration of glucose in the blood can harm body cells as a result of osmosis.
Explain why.

(4)
(Total 8 marks)

Q15.

Some students set up this experiment to investigate osmosis. They filled two pieces of dialysis [visking] tubing with different liquids and left them both in a beaker of 5% sucrose solution for an hour.



- (a) Describe and explain the likely results after one hour.

(6)

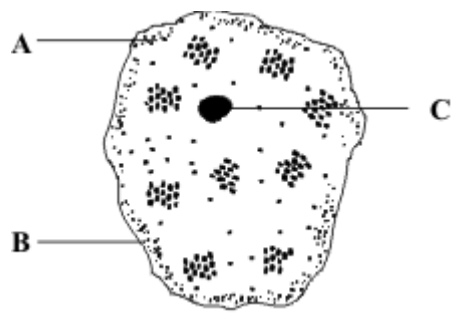
(b) Describe **two** examples where osmosis is used in living things.

(2)

(Total 8 marks)

Q16.

The diagram shows an animal cell.



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

A Name

Function _____

B Name

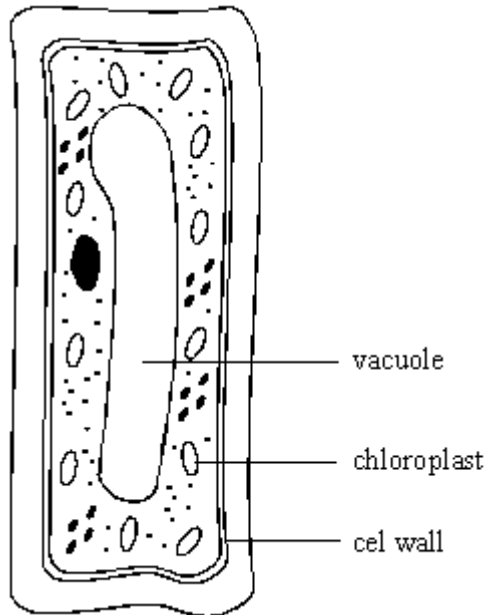
Function _____

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 _____

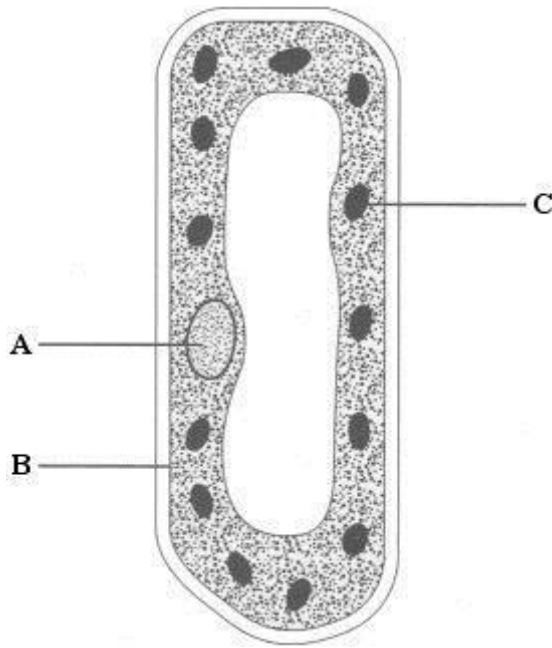
Vacuole function _____

(3)

(Total 12 marks)

Q17.

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)

Q18.

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.

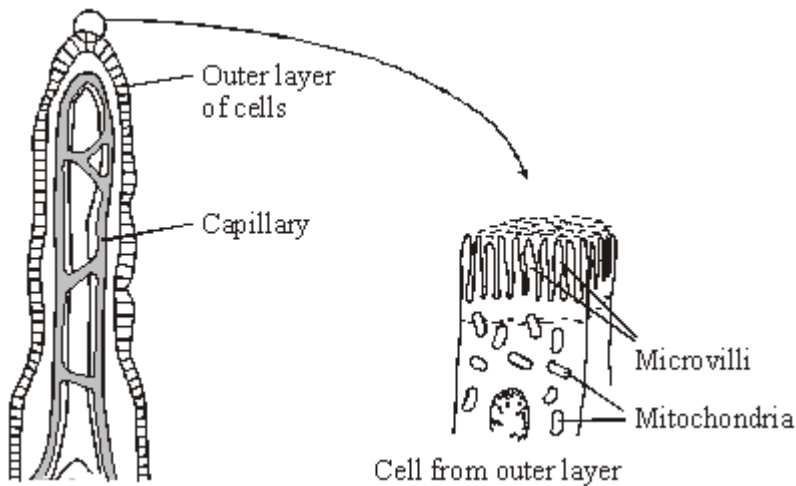
How does the structure of plant cells prevent them from bursting?

(1)

(Total 4 marks)

Q19.

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 _____

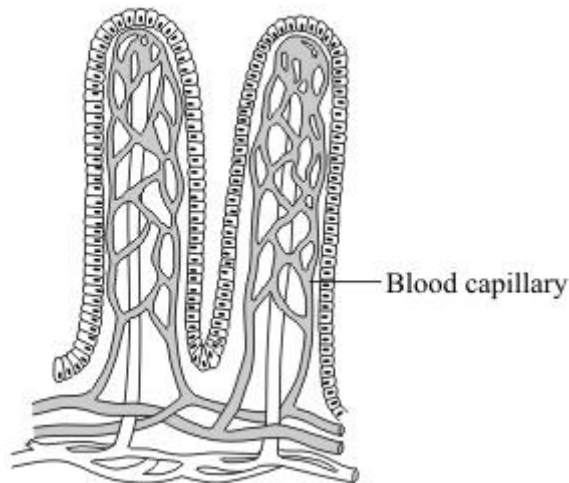
(2)

(Total 4 marks)

Q20.

Diagram 1 shows two villi in the small intestine of a healthy person.

Diagram 1



- (a) Describe **two** features of the villi which help the small intestine to function.

1. _____

2. _____

(2)

- (b) **Diagram 2** shows two villi in the small intestine of a person with coeliac disease.

Diagram 2



- (i) How do the villi of the person with coeliac disease differ from those of a healthy person?

(1)

- (ii) Suggest how this difference might affect how well the small intestine functions.

(1)

(Total 4 marks)

Q21.

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?

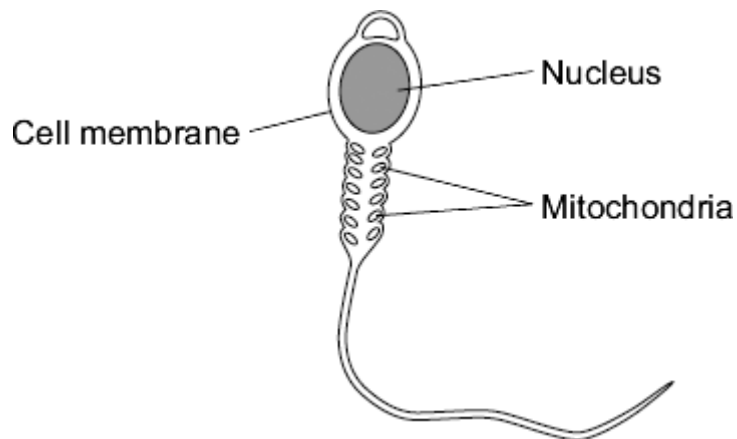
(1)

(Total 7 marks)

Q22.

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.

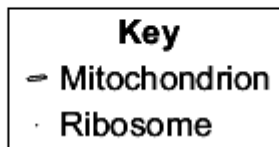
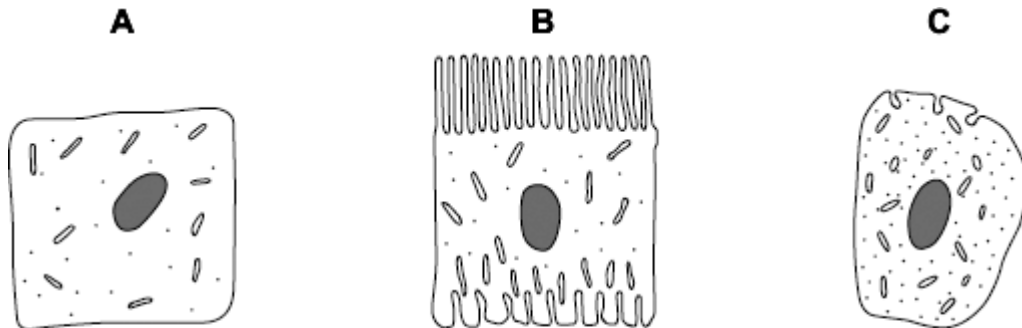
(1)

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

Explain why.

Q23.

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.

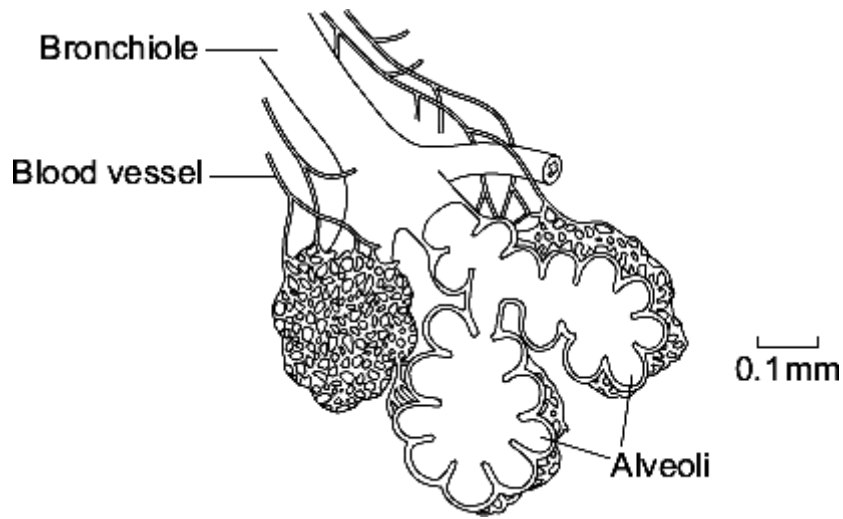
(1)

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

(2)

Q24.

The human lung has about 80 million alveoli.
The diagram shows some alveoli in a human lung.



(a) Give **three** features of the alveoli that allow large amounts of oxygen to enter the blood.

1. _____

2. _____

3. _____

(3)

(b) (i) Name the process by which oxygen passes from the air into the blood.

(1)

(ii) Breathing allows large amounts of oxygen to enter the blood.

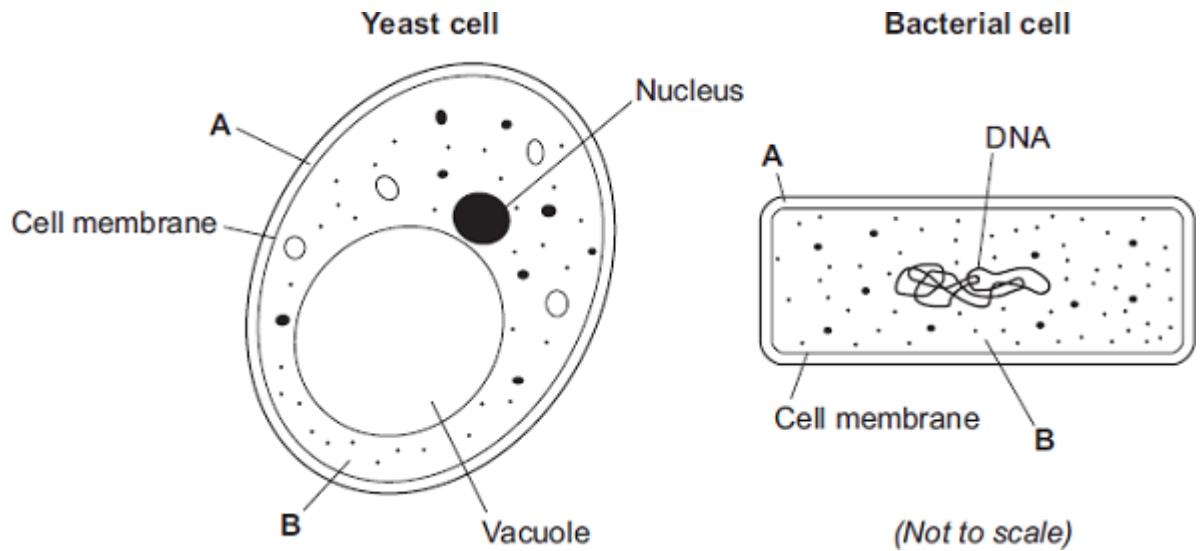
Explain how breathing does this.

(2)

(Total 6 marks)

Q25.

(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)

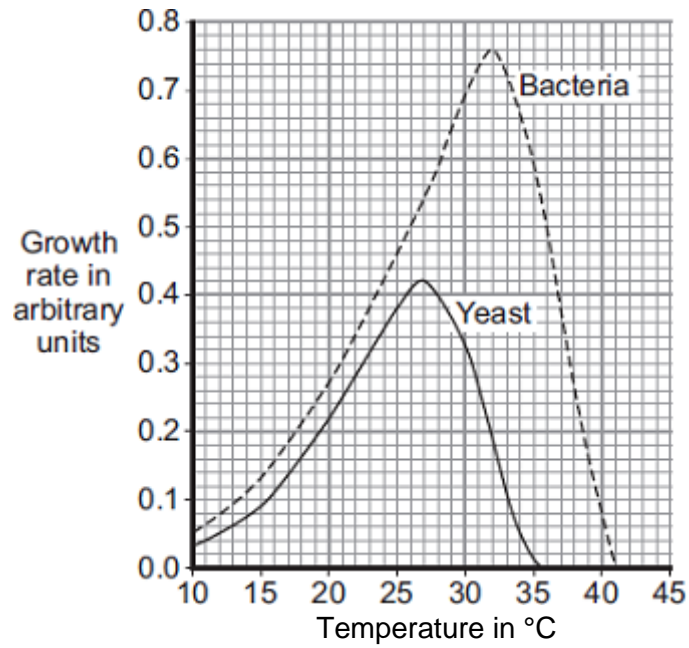
- (ii) The yeast cell and the bacterial cell have different shapes and sizes.

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.

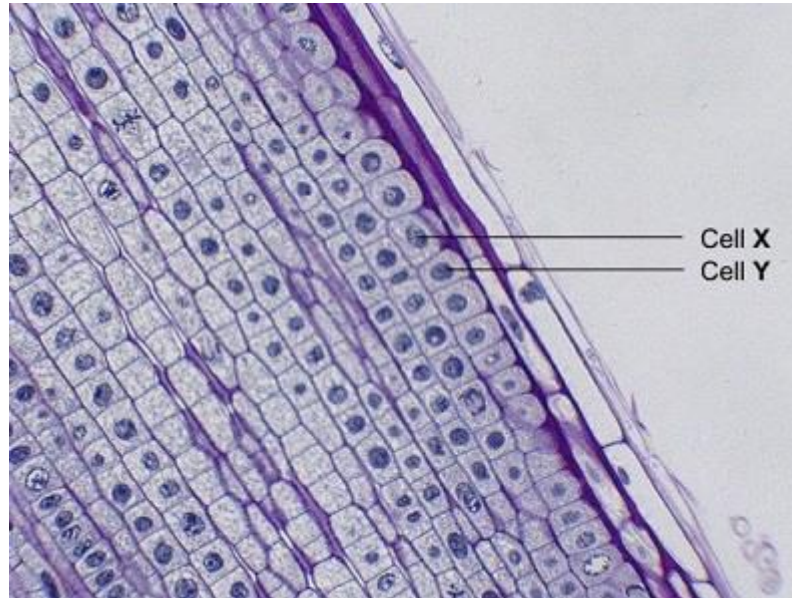
Use information from the graph to explain why.

(2)

(Total 7 marks)

Q26.

The photograph shows some cells in the root of an onion plant.



By UAF Center for Distance Education [CC BY 2.0], via Flickr

(a) Cells X and Y have just been produced by cell division.

(i) Name the type of cell division that produced cells X and Y.

(1)

(ii) What happens to the genetic material before the cell divides?

(1)

(b) A gardener wanted to produce a new variety of onion.

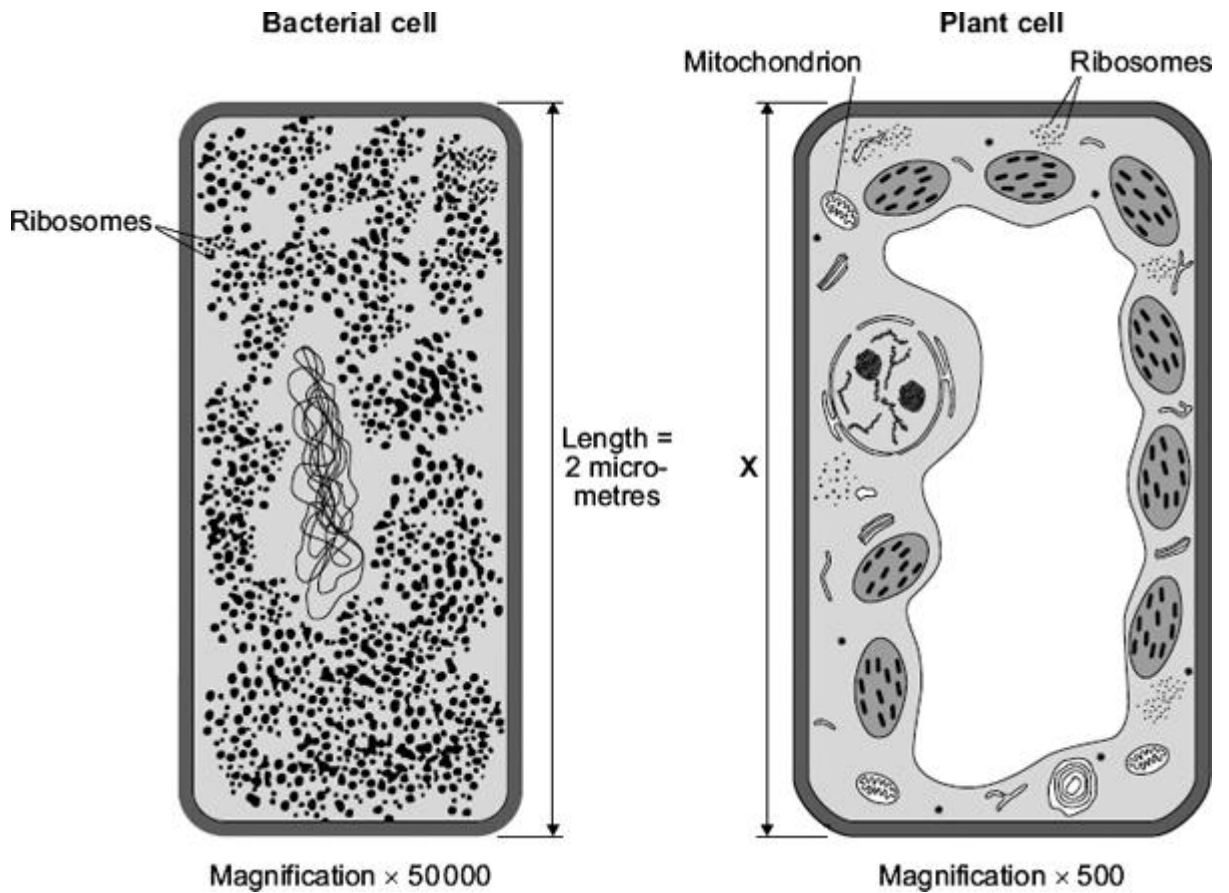
Explain why sexual reproduction could produce a new variety of onion.

(3)

(Total 5 marks)

Q27.

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.

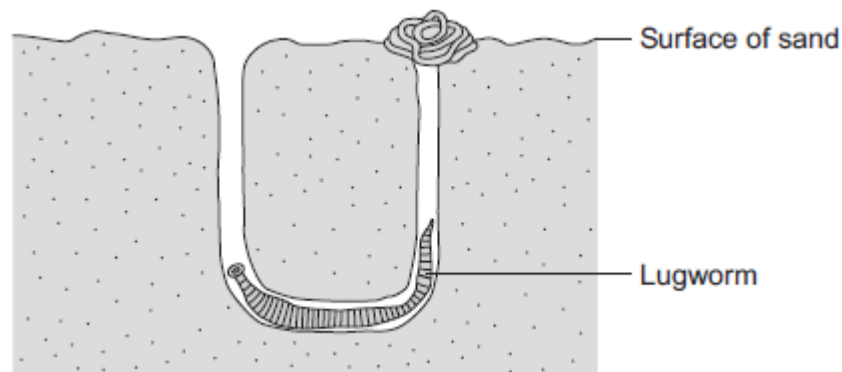
(1)

(Total 5 marks)

Q28.

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

The diagram below shows a lugworm in its burrow.



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

The scientists:

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

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

(1)

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

(1)

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

(1)

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

(1)

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

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

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

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

Use information from the table in your answer.

(2)

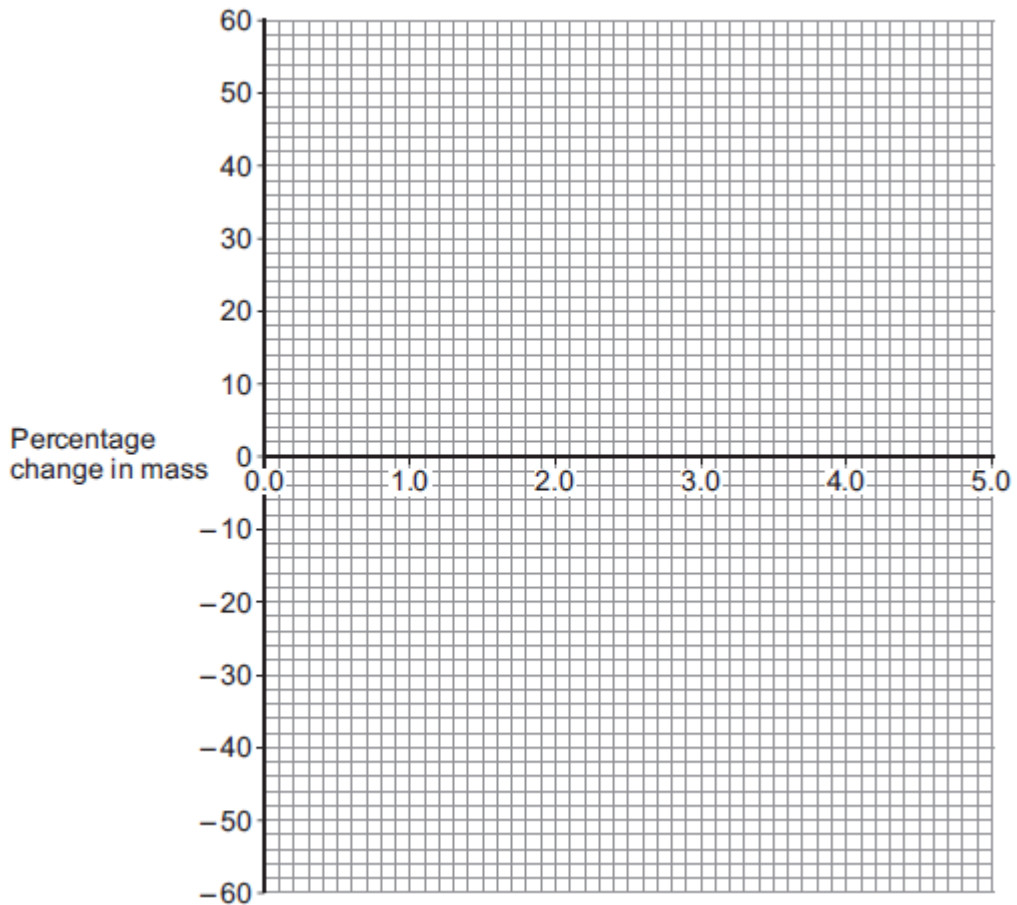
- (ii) Calculate the percentage change in mass for the 10 lugworms in the salt solution with a concentration of 2.0 arbitrary units.

Percentage change in mass = _____ %

(2)

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

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



(4)

- (ii) The scientists thought one of their results was anomalous.

Draw a ring around the anomalous result on your graph.

(1)

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

(1)

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

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

Concentration = _____ %

Reason _____

(2)

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

Explain what caused this.

(3)

(Total 19 marks)

Q29.

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

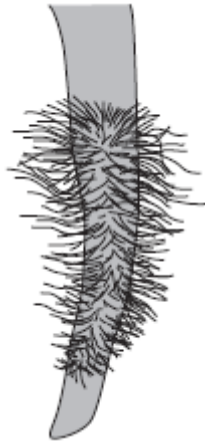
Diffusion is an important process in animals and plants.

The movement of many substances into and out of cells occurs by diffusion.

Describe why diffusion is important to animals and plants.

In your answer you should refer to:

- animals
- plants
- examples of the diffusion of named substances.



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

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

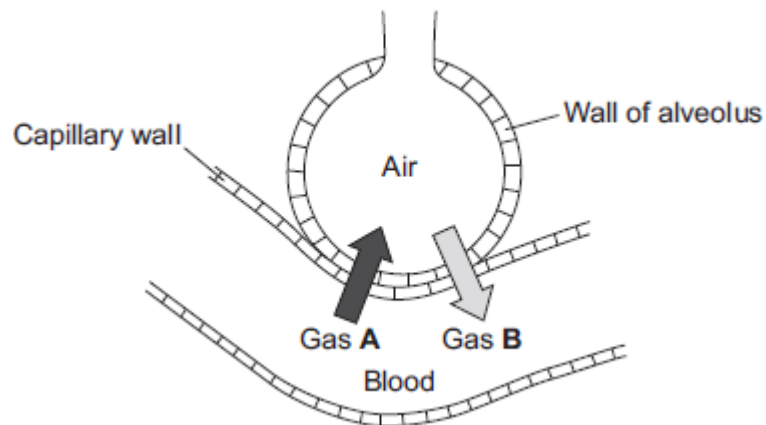
(3)
(Total 6 marks)

Q31.

Gas exchange takes place in the lungs.

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

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



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

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

diffusion.

osmosis.
respiration.

(1)

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

Gas **A** is then breathed out.

Name Gas **A**.

(1)

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

Draw a ring around the correct answer.

platelets

red blood cells

white blood cells

(1)

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

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

Calculate the total surface area of a human lung.

Answer _____ m^2

(2)

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

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

(1)

(Total 6 marks)

Q32.

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.

- (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 East	South 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)

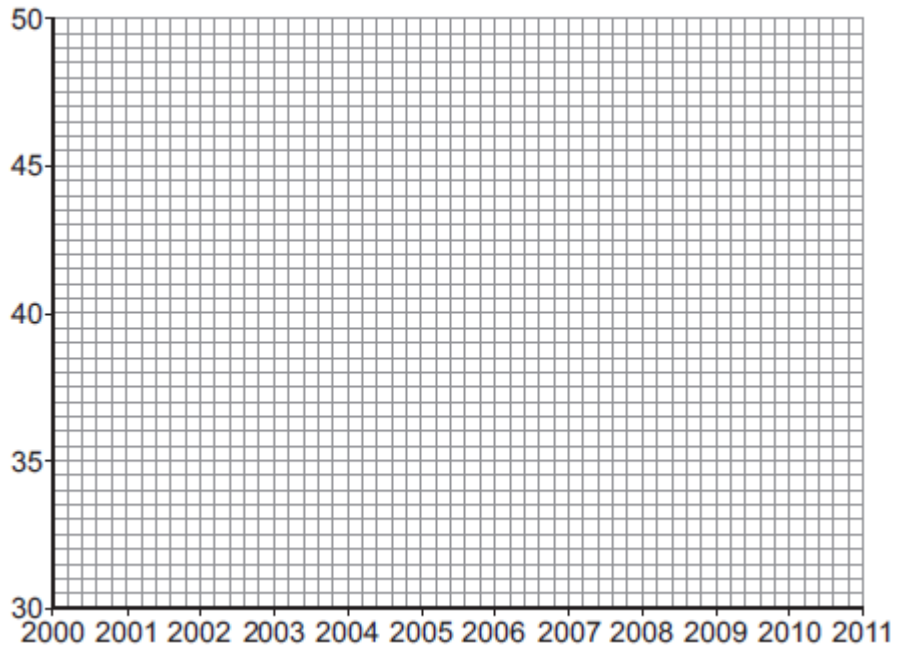
- (ii) Describe the pattern in the data for cases of TB in the South East.

(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.

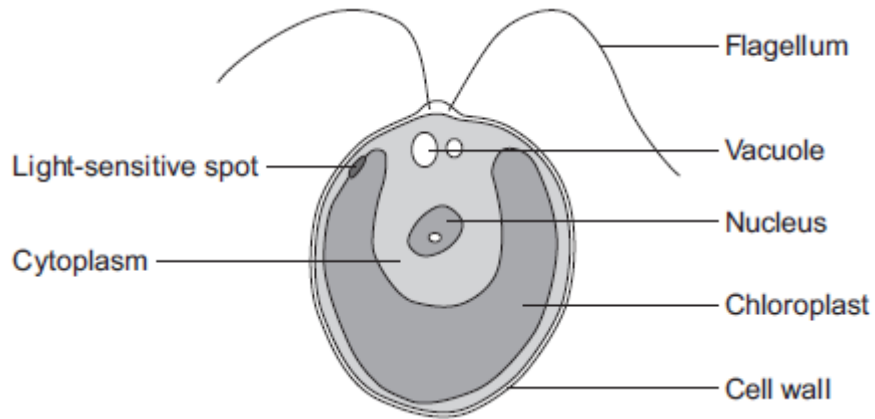
Details of how a vaccine works are **not** required.

(2)

(Total 13 marks)

Q33.

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.

water + _____ $\xrightarrow{\text{Light energy}}$ _____ + oxygen (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.

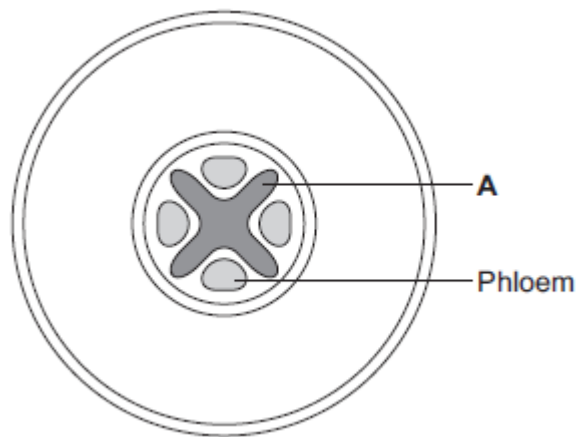
Explain why single-celled organisms, like algae, do **not** need complex structures for gas exchange.

(3)

(Total 11 marks)

Q34.

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)

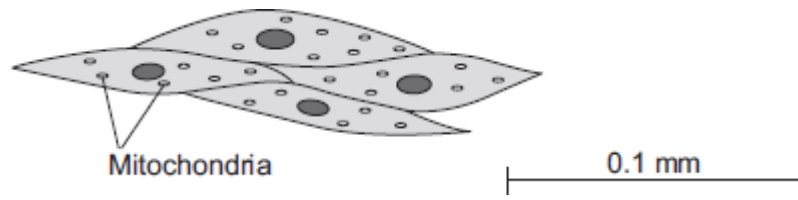
(ii) Explain why active transport is necessary in root hair cells.

(2)

(Total 9 marks)

Q35.

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) **Figure above** is highly magnified.

The scale bar in **Figure above** represents 0.1 mm.

Use a ruler to measure the length of the scale bar and then calculate the magnification of **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 **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)

Q36.

Students used quadrats to estimate the population of dandelion plants on a field.

(a) Describe how quadrats should be used to estimate the number of dandelion plants in a field.

(4)

(b) The field measured 40 m by 145 m.

The students used 0.25 m² quadrats.

The students found a mean of 0.42 dandelions per quadrat.

Estimate the population of dandelions on the field.

Estimated population of dandelions = _____

(2)

(c) In one area of the field there is a lot of grass growing in the same area as dandelions.

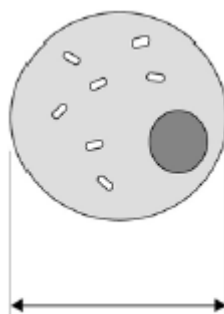
Suggest why the dandelions may **not** grow well in this area.

(4)
(Total 10 marks)

Q37.

Figure 1 shows a cell viewed through a light microscope.

Figure 1



The size of the real cell is 0.03 mm.

(a) Calculate the magnification of the microscope.

Use **Figure 1** to help you answer.

Magnification = _____

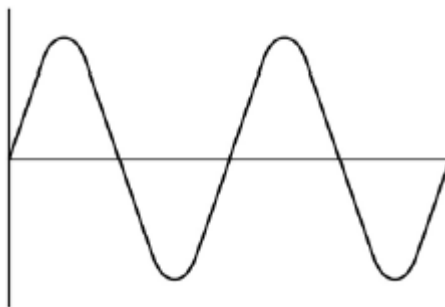
(2)

(b) A light microscope uses light waves to observe objects.

Light waves can be modelled using water waves.

Figure 2 shows a water wave.

Figure 2



Give **one** similarity between a light wave and a water wave.

_____ (1)

(c) Write down the equation that links frequency, wave speed and wavelength.

_____ (1)

(d) The wave in **Figure 2** has a wavelength of 75 cm.

The wave moves at a speed of 1.6 m / s.

Calculate the frequency of the wave.

Frequency = _____ Hz (4)
 (Total 8 marks)

Q38.

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

The table below gives statements about cell division.

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

The first row has been done for you.

Statement	Mitosis only	Meiosis only	Both mitosis and meiosis
How cells are replaced	✓		

How gametes are made			
How a fertilised egg undergoes cell division			
How copies of the genetic information are made			
How genetically identical cells are produced			

(4)

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

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

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

(1)

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

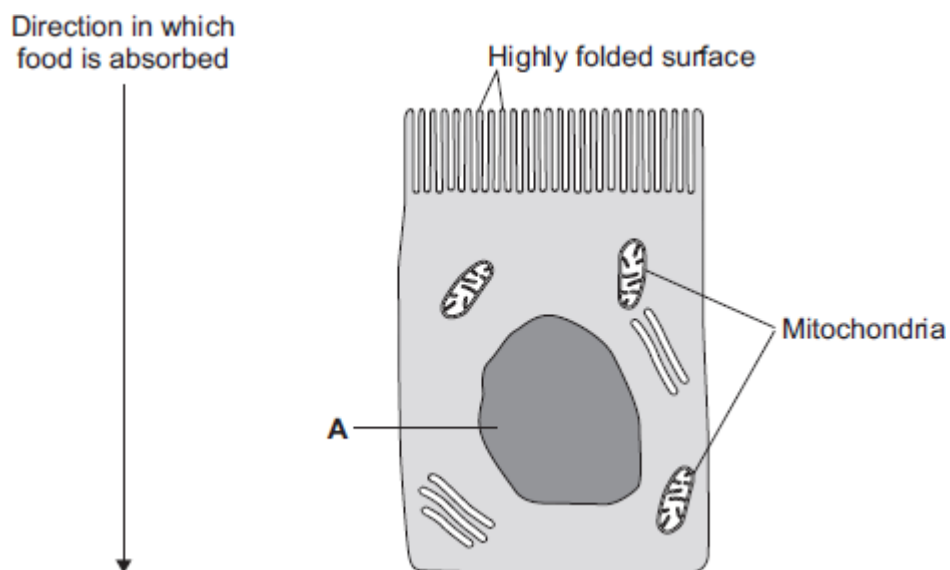
Give **one** advantage of using stem cells from embryos, compared with cells from the source you named in part (i).

(1)

(Total 6 marks)

Q39.

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)

Mark schemes

Q1.

- (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]

Q2.

- (a) movement of water [1]

from high concentration (of water) to low concentration (of water)

or

from (an area of) dilute solution to an area of concentrated solution [1]

through a differentially **or** partially **or** selectively **or** semi permeable membrane [1]

3

- (b) (i) it will rise

1

- (ii) water enters visking tubing [1]

because the concentration of water outside is greater than the concentration inside

or

because the concentration of salt **or** solute is greater inside the tubing than outside [1]

or

to equalise concentration water has to enter visking tubing [2]

2

[6]

Q3.

- (a) circles round right hand **X** and **Y** gametes

*put two ticks **or** crosses by the circles*

2

- (b) 50:50 **or** 1:1 **or** 50% **or** 0.5 **or** ½ equal **or** evens

credit even

*do not accept 2:1 **or** 50 / 50*

- (c) (i) 23 1
- (ii) 23 1
- credit the same as the one above to be marked consequential* 1
- (d) DNA 1
- do not accept nucleic acid* 1
- (e) same 1

[7]

Q4.

- (a) 6 6 6 1
- all required*
- accept a '6n 6 n n 6n' version of the balanced equation provided it is correct in every detail*
- (b) any **two** of 2
- (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
- (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
- palisade cells**
- any **two** of
- * near the upper surface
 - * contain (a great) many **or** more chloroplasts
 - * (so) contain the most chlorophyll

(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]

Q5.

(a) A – (cell) membrane

allow phonetic spelling

1

B – cytoplasm

1

C – nucleus

1

(b) any **two** from:

• to react / respond (to the surroundings)

ignore brain / nervous system reacts

ignore adapt

• avoid dangers / prevent harm to body

allow examples eg to prevent body being burned by hot object

• to coordinate behaviour / process information

ignore send messages

2

[5]

Q6.

(i) 6 in both spaces

do not credit if any formula has been altered

1

(ii) glucose

*allow fructose **or** dextrose*

1

(iii) mitochondria

Q7.

- (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 <i>accept contains genetic material or genes or chromosomes or stores information do not credit the brain of the cell</i>
---------	--

cytoplasm occurs	where respiration occurs <i>accept contains food or mitochondria or reactions occurs</i>
---------------------	---

membrane chemicals	less water or <i>accept surrounds the cell or lets some things in but not others do not credit keeps things out or protection in and or out</i>
-----------------------	---

mitochondria	where energy released <i>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</i>
--------------	---

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]

Q8.

(a) asexual reproduction

1

(b) mitosis

1

(c) clones

1

(d) 44

1

[4]

Q9.

(a) (i) A

(ii) B

for 1 mark each

2

(b) diffusion

*(reject osmosis)
for one mark*

1

(c) C

because uptake against a concentration / diffusion gradient
(reject osmosis)

(if C not given, then idea of movement essential)

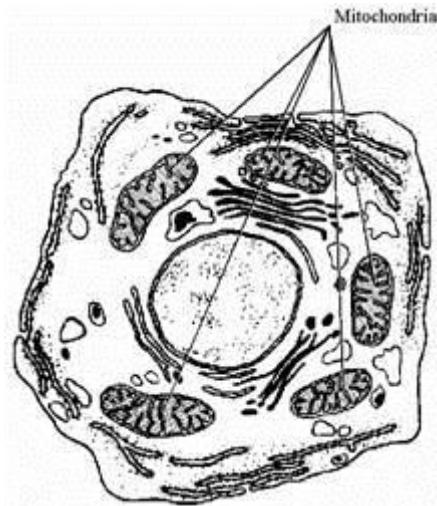
for 1 mark each

2

[5]

Q10.

(a) (i)



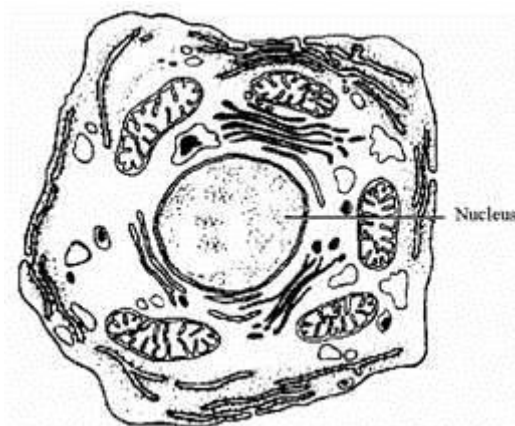
award 1 mark for any of the mitochondria correctly labelled if a number are labelled and one is incorrect award 0 marks

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]

Q11.

- (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]

Q12.

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

urea

carbon dioxide

water

lactic acid

2

- (ii) higher concentration of glucose **or** more glucose in blood than cells

1

diffuses across

1

[4]

Q13.

- (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]

Q14.

- (a) (i) 6

1

- (ii) 4

1

- (b) (i) pancreas

ignore islets of langerhans

1

- (ii) 'X' anywhere between >1 and ≤ 2 hours
anywhere in that column

1

- (c) any **four** from:

water movement

*do **not** accept solution*

out of cells

dilute to concentrated solution

accept reference to correct gradient -

*high Ψ to low Ψ **or** high to low 'water concentration'*

*must be unambiguous – i.e. **not** 'high to low concentration'*

accept low to high concentration

reference to partially / selectively
 permeable membranes **or** described

cells shrink / get smaller

allow crenated

ignore plasmolysed / flaccid / floppy

etc

4

[8]

Q15.

- (a) award **3** marks per tube for each key idea

for tube 1:

expands **or** gets firmer **or** bigger **or** inflates

it gains water

because the concentration of water is less than its surroundings

make sure answer is about water movement and not sucrose

solution

3

for tube 2

gets floppy **or** flaccid **or** contracts

it loses water

because the concentration of water is greater than its surroundings

3

(b) any 2 from:

uptake of water by root (hair) **or**
movement from cell to cell within
plant

*do **not** credit references to diffusion unless it is clear that the
candidate is referring to the diffusion of water*

guard cell function

maintain turgor

water absorption in the large intestine

reabsorption of water from the
nephron **or** collecting duct or in
kidney **or** osmoregulation in kidney

allow osmosis in other animals if some use is shown

2

[8]

Q16.

(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

*do **not** accept by themselves:
protects cell*

	<i>gives shape</i>	1
	controls what enters/leaves the cell	1
	or contains the cell/holds the cell together <i>do not accept keeps harmful substances out</i>	
	or allows movement into and out of the cell C nucleus	1
	contains the genetic material/DNA/genes/chromosomes <i>do not accept:</i> <i>brain of the cell</i> <i>stores information/instructions</i> <i>tells cell what to do</i>	
	or controls (the activity) of the cell	1
(b)	(i) one mark for each correctly labelled part <i>cell wall</i> <i>do not accept anything inboard of the inner edge vacuole</i> <i>accept anything inboard of transplant</i>	
	chloroplast: site of photosynthesis/ for photosynthesis <i>accept word equation or balanced equation</i>	1
	cell wall: supports the cell/keeps the shape/keeps it rigid <i>do not accept protects the cells</i>	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]

Q17.

(a)	A = nucleus <i>accept phonetic spelling only</i>	1
	B = (cell) membrane <i>accept plasma membrane</i>	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]

Q18.

(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

Q19.(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
accept have carriers

1

mitochondria – release energy **or** make ATP
*do **not** accept 'makes energy'*

1

[4]

Q20.(a) any **two** from:

- large surface / area **or** many villi **or** have microvilli
accept big surface / area
- thin surface **or** thin wall **or** surface 1-cell thick **or** capillaries near surface **or** permeable **or** partially permeable
accept they are thin
*do **not** allow thin **cell** wall*
- many blood vessels **or** many capillaries **or** capillary network **or** good blood supply
ignore 'constant blood flow' owtte
ignore extras eg moist or reference to gases
- have enzymes
ignore release enzymes
 - *accept reference to lacteal as 5th point*
 - *allow reference to having mitochondria*

2

(b) (i) small(er) (surface area) / flat(ter) / short(er)
or not as folded
or fewer capillaries owtte*allow small(er) lacteal**ignore references to wide / thick / spread out etc*

1

(ii) less absorption (of digested food) / less digestion / diffusion
accept slower for less
accept description of less digestion

accept less food can get in
*do **not** allow zero absorption*
*do **not** allow 'collection' of nutrients*

1

[4]

Q21.

(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]

Q22.

(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]

Q23.

(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]

Q24.

- (a) large surface / large area 1
- thin / short distance (from air to blood) / one cell thick / two cells thick 1
- good blood supply / many capillaries / capillary network / many blood vessels
ignore moist surface 1
- (b) (i) diffusion
ignore gaseous exchange 1
- (ii) brings (more) oxygen / air into the lungs / alveoli 1
- keeps O₂ level high in alveoli
- or**
- maintains concentration difference (between alveoli and blood) / keeps O₂ concentration in alveoli > O₂ concentration in blood gains **2** marks 1

[6]

Q25.

- (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]

Q26.

(a) (i) mitosis
correct spelling only

1

(ii) replicates / doubles / is copied / duplicates
accept cloned
ignore multiplied / reproduced

1

(b) fertilisation occurs / fusion (of gametes)
accept converse for asexual, eg none in asexual / just division in asexual

1

so leading to mixing of genetic information / genes / DNA / chromosomes
genes / DNA / chromosomes / genetic information comes from 1 parent in asexual
ignore characteristics

1

one copy (of each allele / gene / chromosome) from each parent
or
gametes produced by meiosis
or
meiosis causes variation
meiosis must be spelt correctly

1

[5]

Q27.

(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

$\frac{2 \times 50,000}{500}$ **or**
if answer incorrect, allow 1 mark for
 $\frac{100,000}{500}$
or 100

2

- (ii) bacterial cell is too small / bacterial cell about same size as a mitochondrion / 'no room'
ignore references to respiration

1

[5]

Q28.

- (a) (i) variation in masses / more representative / more typical / more reliable / average / mean / reference to anomalies

or

one worm to light to measure change

do not allow more accurate / more precise

ignore fair test / valid / repeatable / reproducible

1

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

1

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

1

- (iv) equal sizes of worm / more worms (in each group) / wash off all the sand / repeats / use more accurate balance / use smaller concentration intervals

allow reference to improve blotting technique eg blot before / blot more thoroughly

1

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

1

allows comparisons / shows pattern / shows trend

1

- (ii) (+)20

correct answer = 2 marks, with or without working

or

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

for 1 mark

2

- (c) (i) graph:

points correct

- allow ± 1 mm*
-1 mark per error
allow ecf from part b(ii) 2
- label on x-axis including units – ie Concentration of salt in arbitrary units 1
- line of best fit = smooth curve / ruled straight line
anomaly (4.0, -52) either plotted and ignored re. line
or not plotted
do not allow point to point
allow best fit for ecf from 2bii 1
- (ii) on graph:
 ring drawn around point at (4.0, -52)
allow (5.0, -50) if cand. line indicates this 1
- (iii) sensible suggestion – eg used wrong solution / used 5.0% instead of 4.0% / different length of time in solutions / ref to error in blotting / balance not zeroed / error in weighing
allow some lugworms died
allow error in calculation 1
- (d) (i) 2.9 to 3.0 / correct for candidate's graph ± 0.1 1
- value of no change in mass / worms in equilibrium with soln / described
allow small(est) mass change 1
- (ii) water loss 1
- by osmosis / diffusion 1
- from dilute region in the worm to more concentrated solution outside
allow correct description in terms of high to low water
concentration / high to low water potential
salt solution is hypertonic
concentration unqualified = salt concentration 1

[19]

Q29.

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1 – 2 marks)

An example is given of a named substance

or

a process

or

there is an idea of why diffusion is important eg definition.

Level 2 (3 – 4 marks)

At least one example of a substance is given

and

correctly linked to a process in either animals or plants.

Level 3 (5 – 6 marks)

There is a description of a process occurring in either animals or plants that is correctly linked to a substance

and

a process occurring in the other type of organism that is correctly linked to a substance.

examples of points made in the response**Importance of diffusion:**

- to take in substances for use in cell processes
- products from cell processes removed

Examples of processes and substances:

- for gas exchange / respiration: O₂ in / CO₂ out
- for gas exchange / photosynthesis: CO₂ in / O₂ out
- food molecules absorbed: glucose, amino acids, etc
- water absorption in the large intestine
- water lost from leaves / transpiration
- water absorption by roots
- mineral ions absorbed by roots

extra information**Description of processes might include:**

- *movement of particles / molecules / ions*
- *through a partially permeable membrane*
- *(movement of substance) down a concentration gradient*
- *osmosis: turgor / support / stomatal movements*

[6]

Q30.

(a) any **three** from:

- (water through a) partially permeable
accept 'semi permeable' / selectively permeable
- membrane
- from dilute to (more) concentrated solution
allow 'from a high concentration of water to a lower concentration (of water)'
allow 'from high water potential to low water potential'
allow 'down a concentration gradient of water'
*do **not** accept 'along a concentration gradient of water'*

- (it's a) passive (process)
allow requires no energy 3

- (b) (there are) many hairs **or** thin hairs **or** hairs are one cell thick 1

(which gives) large / increased surface area **or** short diffusion pathway 1

(so there is) more diffusion / osmosis (of water into the root)
ignore absorption 1

[6]

Q31.

- (a) (i) diffusion 1

- (ii) carbon dioxide
accept CO₂ / CO₂
*do **not** accept CO²* 1

- (iii) red blood cells 1

- (b) 70
if no / incorrect answer then
70 000 000
or
280 x 0.25 gains 1 mark
ignore doubling the answer 2

- (c) allows more gas / oxygen / CO₂
(exchange)
*do **not** accept air* 1

[6]

Q32.

- (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 <i>allow 'on average it is 5 / 6 times greater'</i>	1
(ii)	increases <i>Included figures must be correct</i>	1
(iii)	overall slight increase <i>accept 'doesn't change much'</i>	1
	variable / goes up and down	1
(c) (i)	both axes correctly labelled x = Year y = Number of cases	1
	correct points <i>all correct = 2 marks</i> <i>1-2 errors = 1 mark</i> <i>> 2 errors = 0 marks</i>	2
	suitable line of best fit <i>accept straight line or smooth curve</i>	1
(ii)	doesn't fit the pattern / line of best fit	1
(d)	provides immunity / protection (to TB) <i>ignore 'stops people catching it'</i> <i>ignore 'resistance'</i>	1
	prevents TB <u>spreading</u> <i>accept ref to herd immunity</i>	1
		[13]
Q33.		
(a) (i)	chloroplast	1
(ii)	cell wall	1
(b) (i)	osmosis <i>accept diffusion</i>	1
(ii)	cell wall (prevents bursting)	1

- (c) (i) carbon dioxide
allow correct formula 1
- 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]

Q34.

- (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' 1
- against their concentration gradient 1
- [9]

Q35.

- (a) contract / shorten
ignore relax
*do **not** allow expand* 1

to churn / move / mix food
accept peristalsis / mechanical digestion
ignore movement unqualified 1

- (b) 400
acceptable range 390-410
allow 1 mark for answer in range of 39 to 41
allow 1 mark for answer in range of 3900 to 4100 2

- (c) to transfer energy for use
allow to release / give / supply / provide energy
*do **not** allow to 'make' / produce' / 'create' energy*
allow to make ATP
ignore to store energy 1

by (aerobic) respiration **or** from glucose
*do **not** allow anaerobic*
*energy released **for** respiration = max 1 mark* 1

- (d) (i) to make protein / enzyme
ignore 'antibody' or other named protein 1

(ii) too small / very small
allow light microscope does not have sufficient magnification / resolution
allow ribosomes are smaller than mitochondria
ignore not sensitive enough
ignore ribosomes are transparent 1

[8]

Q36.

- (a) (placed) randomly
allow description of placement 1

sufficient number (of quadrats) used 1

count (dandelions) in each quadrat 1

use mean number of dandelions, area of quadrat and area of field to estimate population

accept (area of field / area quadrat) × mean number of dandelions per quadrat

(b) $(40 \times 145) / 0.25 = 23\,200$ 1

$(0.42 \times 23\,200 =) 9744$

allow 9744 with no working shown for 2 marks

allow ecf from correct attempt at the previous step) × 0.42 for 1 mark

1

(c) **Level 2 (3–4 marks):**
A detailed and coherent explanation is given. Logical links between clearly identified relevant points are made to explain why dandelion growth may be limited.

Level 1 (1–2 marks):
Discrete relevant points are made. The logic may be unclear.

0 marks:
No relevant content

Indicative content

factors that may be considered:
competition for resources including:

- light
- water
- space
- mineral ions (allow nutrients / salts / ions from the soil)

reference to why growth may be limited:

- (light) energy for photosynthesis
- water as a raw material for photosynthesis / support
- surface area exposed to light
- sugar / glucose produced in photosynthesis
- (space) to grow bigger
- (space) for growth of root system
- (mineral ions) for growth
- (mineral ions / sugar) for production of larger molecules **or** named example

4
[10]

Q37.

(a) $\text{magnification} = \frac{\text{image size}}{\text{real size}}$

$= 29 \div 0.03$

1

= 967

1

allow 967 with no working shown for 2 marks

(b) they are transverse

1

(c) wave speed = frequency × wavelength

allow $v = f \lambda$

1

(d) 75 cm = 0.75 m

1

$1.6 = f \times 0.75$

1

$f = 1.6 \div 0.75$

1

= 2.13 (Hz)

1

allow 2.13 (Hz) with no working shown for 4 marks

[8]

Q38.

(a)

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

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

1
1
1
1

- (b) (i) (adult) bone marrow
accept (umbilical) cord blood, skin, amniotic fluid / membrane 1
- (ii) cells will not be rejected by the patient's body (if they have been produced by therapeutic cloning)
allow easier to obtain linked to embryo stem cells
or
 (embryo stem cells) can develop into many different types of cells
allow doesn't need an operation linked to bone marrow
or
 (embryo stem cells) not yet differentiated / specialised or undifferentiated
accept embryo cells are pluripotent 1
- [6]

Q39.

- (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]