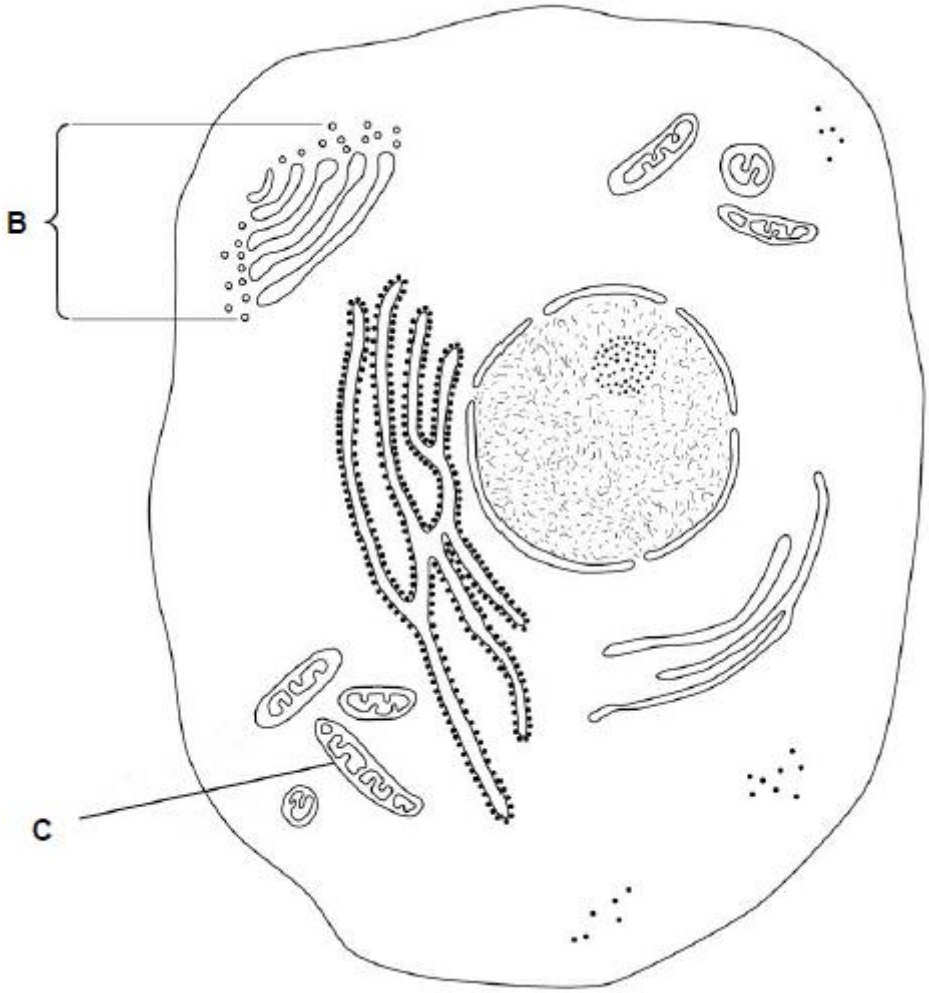
2.5 STUDYING CELLS (1) – QUESTIONS

Q1. Below is a diagram of an animal cell.



(a) Name the organelles labelled:

B _____

C _____ **(2)**

(b) Name **two** structures present in plant cells that are **not** present in animal cells.

1. _____

2. _____ **(1)**

A biologist prepared a sample of organelles labelled **C** from liver. He used the following method.

1. Added to the liver tissues an ice-cold, buffered solution with the same water potential as the liver tissue.
2. Mixed the liver and solution in a blender.
3. Filtered the mixture from the blender.
4. Spun the filtered liquid in a centrifuge at a low speed. A pellet appeared in the bottom of the centrifuge tube.

5. Poured off the liquid above the pellet into a second centrifuge tube and spun this at a higher speed to obtain the sample of organelles labelled **C**.

(c) Explain why the solution the biologist used was ice-cold, buffered and the same water potential as the liver tissue (step 1).

Ice-cold_____

_____

Buffered_____

_____

Same water potential_____

_____ **(3)**

(d) Explain why the biologist used a blender and then filtered the mixture (steps 2 and 3).

_____

_____

_____

_____

_____ **(2)**

(e) Name the organelle that made up most of the first pellet after centrifuging at a low speed (step 4).

_____ **(1)**

(f) The second centrifuge tube was spun at a higher speed to obtain the sample of organelles labelled **C** in the diagram (step 5).

Suggest why.

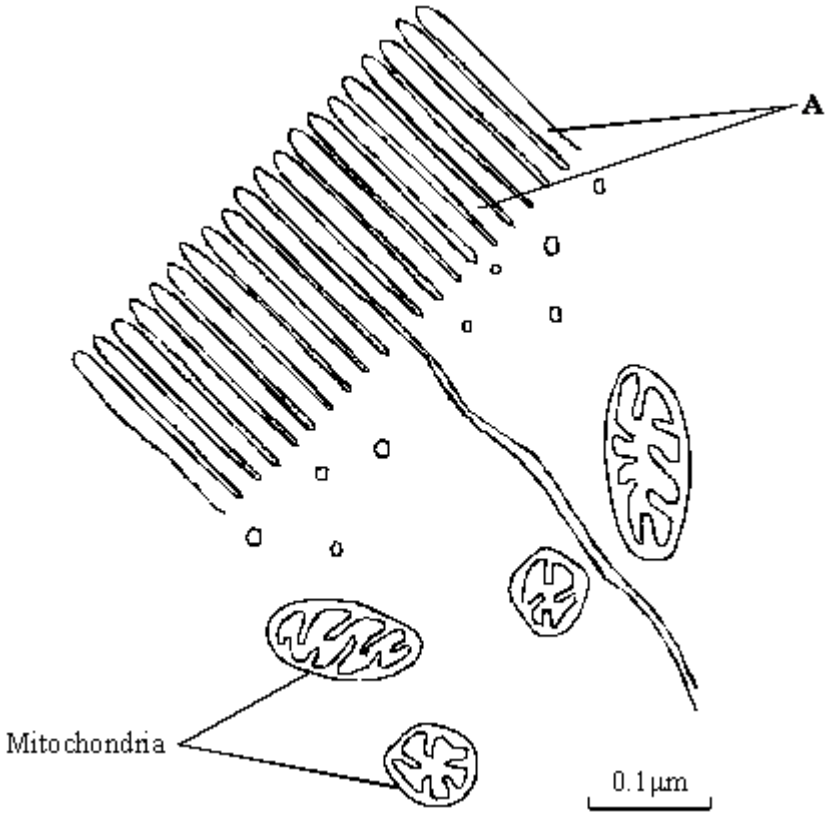
_____

_____

_____ **(1)**

(Total 10 marks)

Q2. The drawing shows an electron micrograph of parts of epithelial cells from the small intestine.



(a) (i) Name the structures labelled **A**.

_____ **(1)**

(ii) Explain how these structures help in the absorption of substances from the small intestine.

_____

_____ **(1)**

(b) (i) The scale bar on this drawing represents a length of 0.1µm. Calculate the magnification of the drawing. Show your working.

Magnification _____

(2)

(ii) Explain why an electron microscope shows more detail of cell structure than a light microscope.

_____

_____

_____ **(2)**

(c) The length of mitochondria can vary from 1.5 µm to 10 µm but their width never exceeds 1µm. Explain the advantage of the width of mitochondria being no more than 1µm.

_____

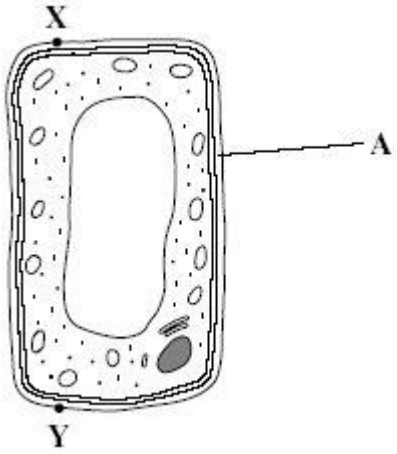
_____ **(1)**

(Total 7 marks)

Q3. (a) Name the process in which cells become adapted for different functions.

_____ **(1)**

(b) Palisade cells are found in leaves. The diagram shows a palisade cell.



(i) Name structure **A**.

_____ **(1)**

(ii) The real length of this cell between **X** and **Y** is 20 micrometres (µm). By how many times has it been magnified? Show your working.

Answer _____

(2)

(iii) Explain **one** way in which this cell is adapted for photosynthesis.

_____

_____ **(1)**

(Total 5 marks)

Q4. A student found the number of stomata per cm^2 on the lower surface of a daffodil leaf. He removed a small, thin piece of lower epidermis and mounted it on a microscope slide.

He examined the slide using an optical microscope.

(a) Explain why it was important that the piece of the epidermis that the student removed was thin.

_____

_____

_____

_____ **(2)**

(b) Suggest how the student could have used his slide to find the number of stomata per cm^2.

_____

_____

_____

_____

_____

_____ **(3)**

(c) The stomata on the leaves of pine trees are found in pits below the leaf surface. Explain how this helps to reduce water loss.

_____

_____

_____

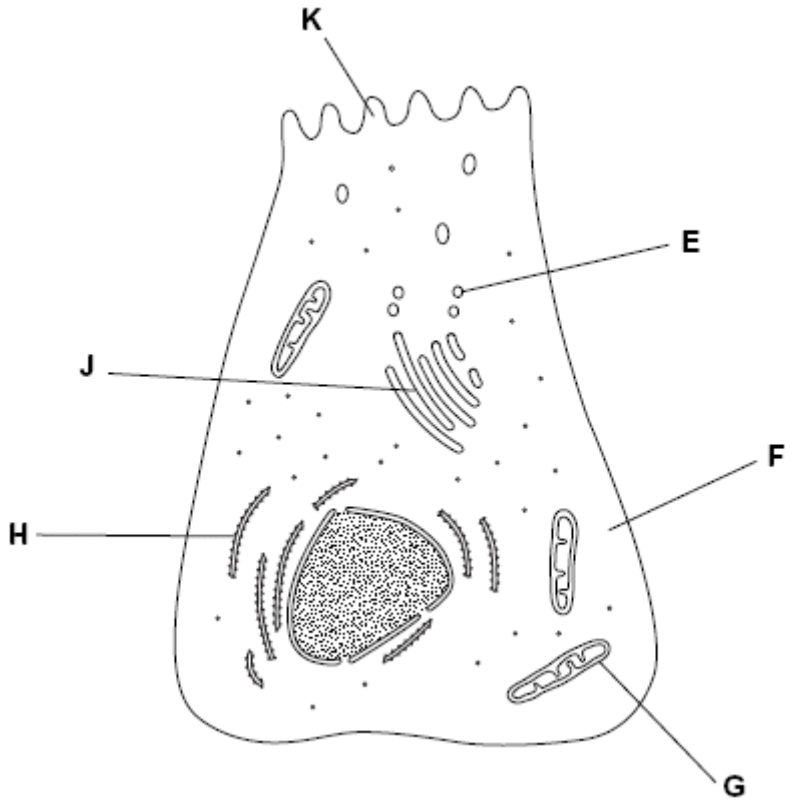
_____ **(2)**

(Total 7 marks)

Q5. (a) Name the type of bond that joins amino acids together in a polypeptide.

_____ **(1)**

The diagram shows a cell from the pancreas.



(b) The cytoplasm at **F** contains amino acids. These amino acids are used to make proteins which are secreted from the cell.

Place the appropriate letters in the correct order to show the passage of an amino acid from the cytoplasm at **F** until it is secreted from the cell as a protein at **K**.

F				**K**

(2)

(c) There are lots of organelle **G** in this cell. Explain why.

_____

_____

_____

_____ **(2)**

(d) A group of scientists homogenised pancreatic tissue before carrying out cell fractionation to isolate organelle **G**.

Explain why the scientists

(i) homogenised the tissue

_____

_____ **(1)**

(ii) filtered the resulting suspension

_____

_____ **(1)**

(iii) kept the suspension ice cold during the process

_____

_____ **(1)**

(iv) used isotonic solution during the process.

_____

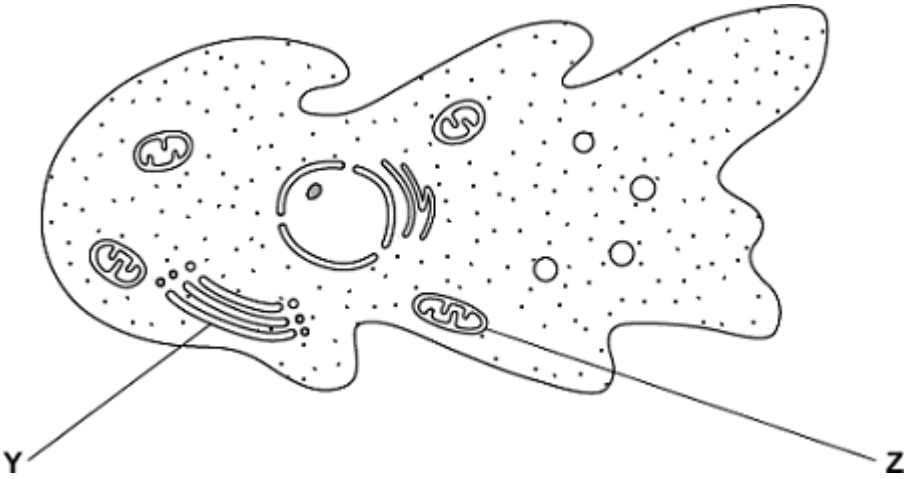
_____

_____

_____ **(2)**

(Total 10 marks)

Q6. An amoeba is a single-celled, eukaryotic organism. Scientists used a transmission electron microscope to study an amoeba. The diagram shows its structure.



(a) (i) Name organelle **Y**.

_____ **(1)**

(ii) Name **two** other structures in the diagram which show that the amoeba is a eukaryotic cell.

1. _____

2. _____ **(2)**

(b) What is the function of organelle **Z**?

_____

_____

_____ **(1)**

(c) The scientists used a transmission electron microscope to study the structure of the amoeba. Explain why.

_____

_____

_____

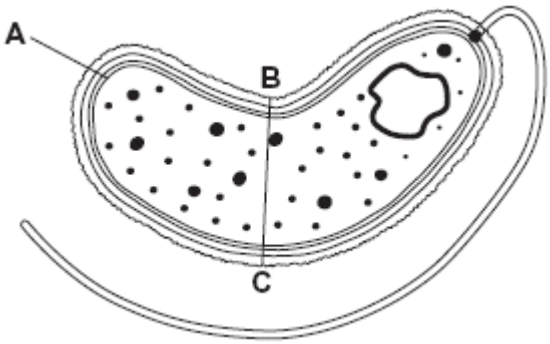
_____

_____

_____ **(2)**

(Total 6 marks)

Q7. The diagram shows a cholera bacterium. It has been magnified 50 000 times.



(a) Name **A**.

_____ **(1)**

(b) Name **two** structures present in an epithelial cell from the small intestine that are **not** present in a cholera bacterium.

1. _____

2. _____ **(2)**

(c) Cholera bacteria can be viewed using a transmission electron microscope (TEM) or a scanning electron microscope (SEM).

(i) Give **one** advantage of using a TEM rather than a SEM.

_____

_____ **(1)**

(ii) Give **one** advantage of using a SEM rather than a TEM.

_____

_____

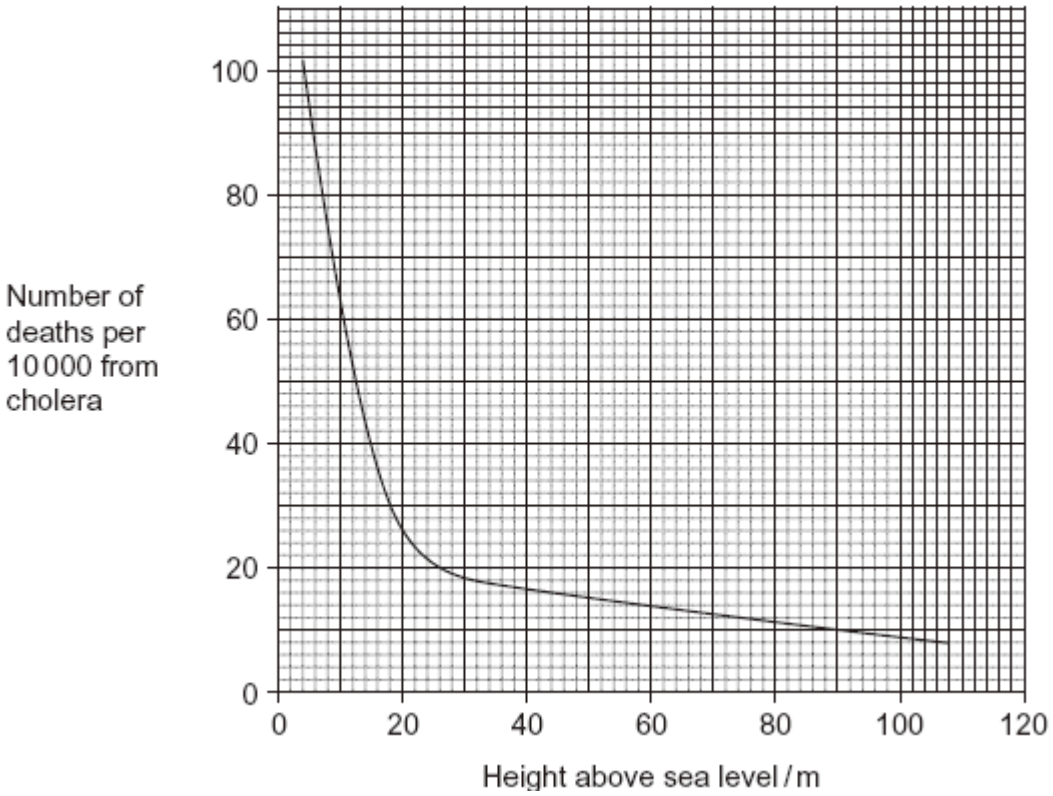
_____ **(1)**

(d) Calculate the actual width of the cholera bacterium between points **B** and **C**.
Give your answer in micrometres and show your working.

_____ µm

(2)

(e) An outbreak of cholera occurred in London in 1849. The graph shows the relationship between the number of deaths from cholera and the height at which people lived above sea level.



Describe the relationship between the number of deaths from cholera and the height at which people lived above sea level.

_____

_____

_____

_____

_____ **(2)**

(Total 9 marks)

Q8. (a) The table shows some statements about three carbohydrates. Complete the table with a tick in each box if the statement is true.

Statement	Starch	Cellulose	Glycogen
Found in plant cells			
Contains glycosidic bonds			
Contains β-glucose			

(3)

(b) Name the type of reaction that would break down these carbohydrates into their monomers.

_____ **(1)**

(c) Give **one** feature of starch and explain how this feature enables it to act as a storage substance.

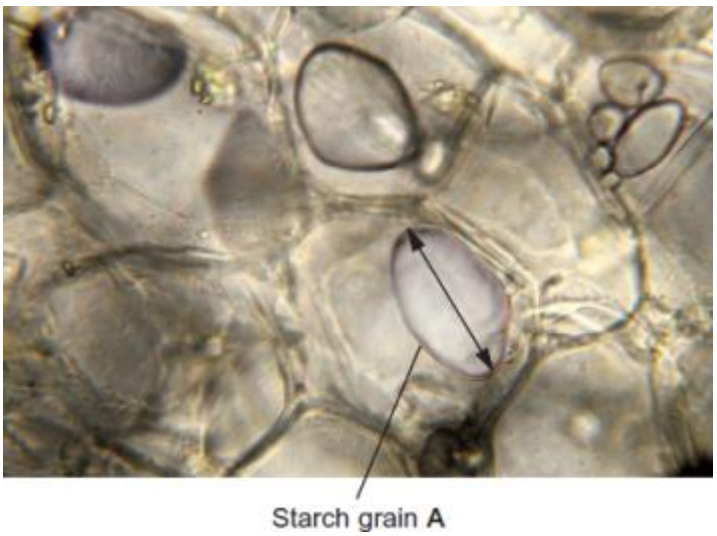
Feature _____

Explanation _____

_____

_____ **(2)**

(d) The picture shows starch grains as seen with an optical microscope. The actual length of starch grain **A** is 48 μm. Use this information and the arrow line to calculate the magnification of the picture. Show your working.



Magnification _____ times

(2)

(Total 8 marks)

Q9. (a) What is a tissue?

_____

_____ **(1)**

(b) A student cut a thin section of tissue from a potato and examined it with an optical microscope.

(i) Starch was present in the cells of this tissue. Describe how the student could find out where in the cells the starch was present.

_____

_____

_____

_____

_____ **(2)**

(ii) The student cut a thin section of the tissue. Explain why it was important that the section was thin.

_____

_____

_____

_____

_____ **(2)**

(c) The cell walls of potato cells contain cellulose. Cellulose and starch are both carbohydrates. Describe **two** ways in which molecules of cellulose are similar to molecules of starch.

_____

_____

_____

_____ **(2)**

(Total 7 marks)

Q10. The image below shows the cell-surface membrane of a red blood cell seen with a transmission electron microscope.

(a) The cell-surface membrane can be seen with a transmission electron microscope but **not** with an optical microscope.

Explain why.

_____

_____

_____ **(1)**

(b) No organelles are visible in the cytoplasm of this red blood cell.

Suggest why.

_____

_____

_____ **(1)**

(c) Before the cell was examined using the electron microscope, it was stained. This stain caused parts of the structure of the cell-surface membrane to appear as two dark lines.

Suggest an explanation for the appearance of the cell-surface membrane as two dark lines.

_____

_____

_____

_____

_____

_____

_____ **(3)**

(d) Describe how substances move across cell-surface membranes by facilitated diffusion.

_____

_____

_____

_____

_____

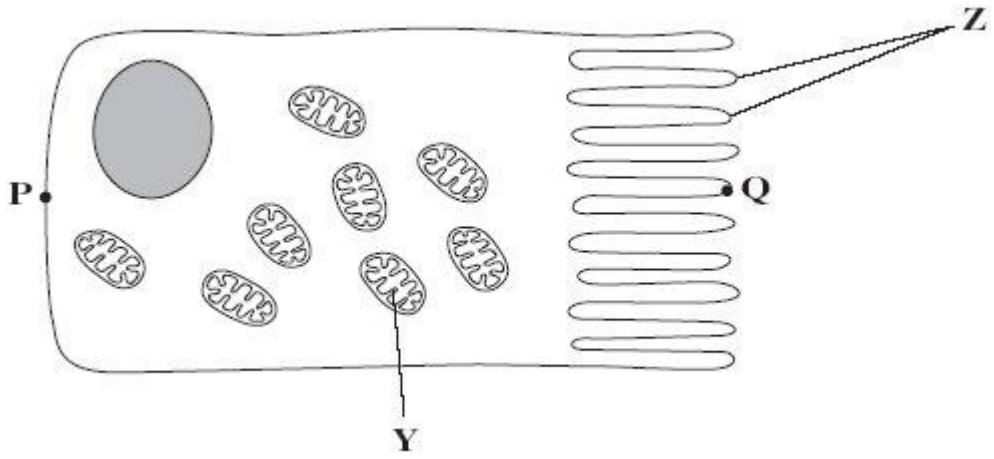
_____

_____

_____ **(3)**

(Total 8 marks)

Q11. The diagram shows an epithelial cell from the small intestine.



(a) (i) Name organelle **Y**.

_____ **(1)**

(ii) There are large numbers of organelle **Y** in this cell. Explain how these organelles help the cell to absorb the products of digestion.

_____

_____

_____

_____

_____ **(2)**

(b) This diagram shows the cell magnified 1000 times. Calculate the actual length of the cell between points **P** and **Q**. Give your answer in µm. Show your working.

Answer _____ µm

(2)

(c) Coeliac disease is a disease of the human digestive system. In coeliac disease, the structures labelled **Z** are damaged.

Although people with coeliac disease can digest proteins they have low concentrations of amino acids in their blood.

Explain why they have low concentrations of amino acids in their blood.

_____

_____

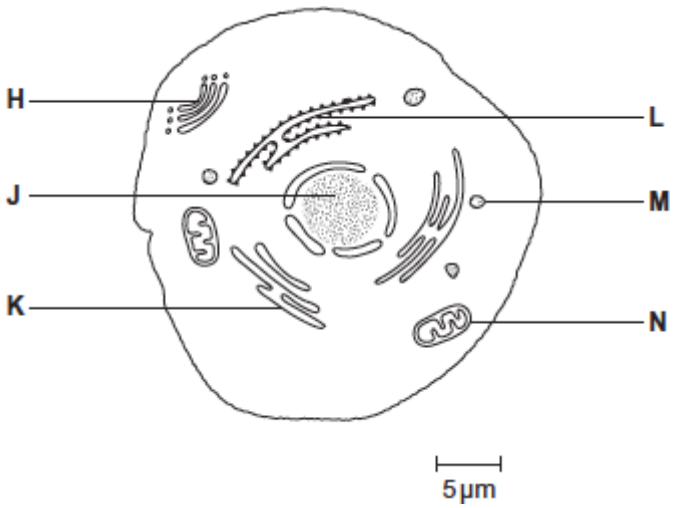
_____

_____

_____ **(2)**

(Total 7 marks)

Q12. The diagram shows a eukaryotic cell.



(a) Complete the table by giving the letter labelling the organelle that matches the function.

Function of organelle	**Letter**
Protein synthesis	
Modifies protein (for example, adds carbohydrate to protein)	
Aerobic respiration	

(3)

(b) Use the scale bar in the diagram above to calculate the magnification of the drawing.

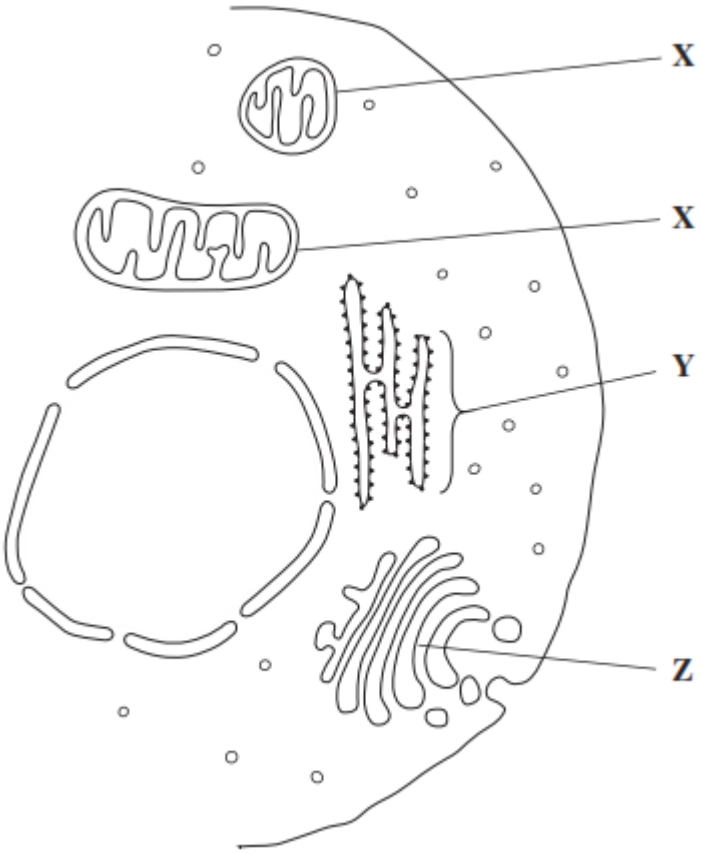
Show your working.

Answer = _____

(2)

(Total 5 marks)

Q13. The drawing shows part of a human cell.



(a) Name organelles

X _____

Y _____ **(2)**

(b) (i) The organelles labelled **X** all have very similar shapes in this cell.
Explain why they appear to have different shapes in this drawing.

_____

_____

(Extra space) _____

_____ **(1)**

(ii) Large numbers of organelles **X** and **Z** are found in mucus-secreting cells. Explain why.

_____

_____

_____

_____

(Extra space) _____

_____ **(2)**

(Total 5 marks)

Q14. (a) Small samples of plant tissue were placed in a cold, isotonic solution and then treated to break open the cells to release the organelles. The different organelles were then separated. Describe a technique that could be used to

(i) break open the cells;

_____

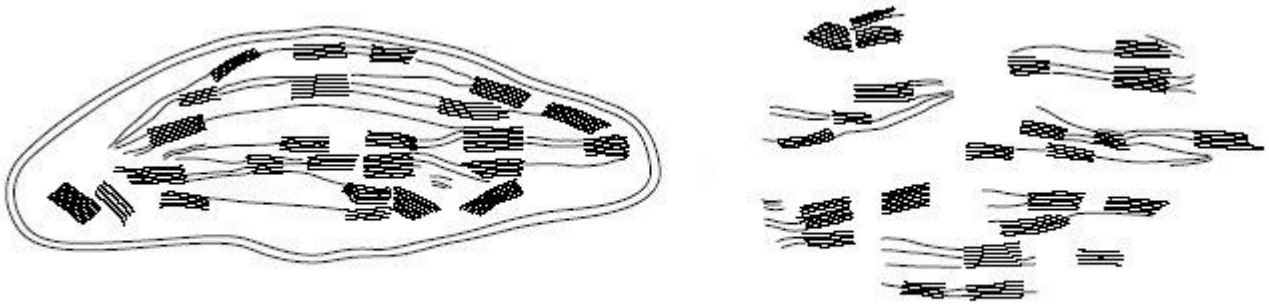
_____

(ii) separate the organelles.

_____

_____ **(2)**

(b) One group of organelles was placed in a hypotonic solution. The diagram shows one of these organelles seen under an electron microscope before and after it was placed in the hypotonic solution.



Before

After

Name the organelle.

_____ **(1)**

(Total 3 marks)

Q15. (a) Describe and explain how cell fractionation and ultracentrifugation can be used to isolate mitochondria from a suspension of animal cells.

(5)

(b) Describe the principles and the limitations of using a transmission electron microscope to investigate cell structure.

(5)

(Total 10 marks)

Q16. Scientists use optical microscopes and transmission electron microscopes (TEMs) to investigate cell structure. Explain the advantages and the limitations of using a TEM to investigate cell structure.

_____

_____

_____

_____

_____

_____

(Total 5 marks)

Q17. (a) The events that take place during interphase and mitosis lead to the production of two genetically identical cells. Explain how.

_____

_____

_____

_____

_____

_____

_____

_____

_____

[Extra space] _____

_____

_____

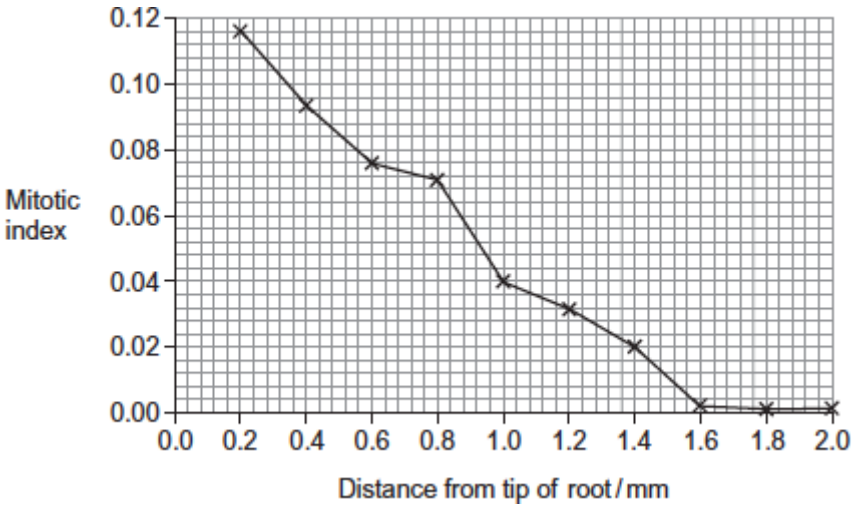
_____ **(4)**

(b) A student cut thin sections of tissue at different distances from the tip of a root. She stained the sections and viewed them with an optical microscope.

For each section, the student counted the number of cells in mitosis and the total number of cells in each field of view. She then calculated a **mitotic index** for each section using the equation:

$$\text{mitotic index} = \frac{\text{number of cells in mitosis}}{\text{total number of cells}}$$

The student's results arer shown in the graph.



(i) The student cut thin sections of tissue to view with an optical microscope. Explain why it was important that the sections were thin.

_____

_____

_____

_____

_____ **(2)**

(ii) What does the graph show about the growth of roots? Use the data to explain your answer.

_____

_____

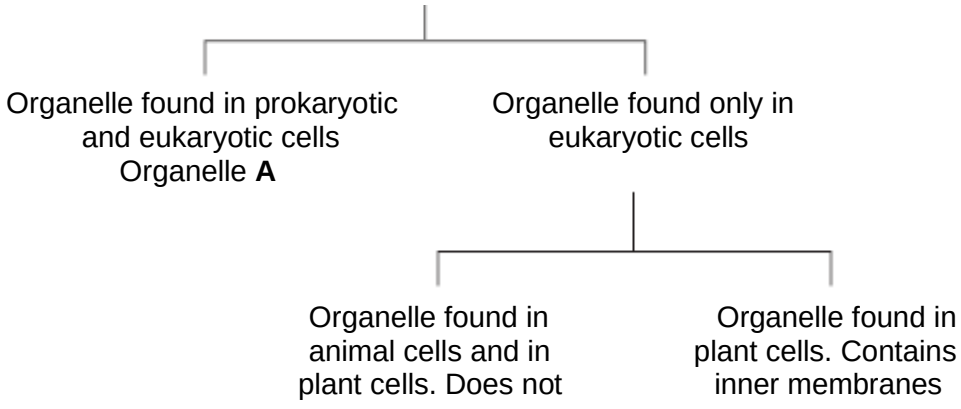
_____

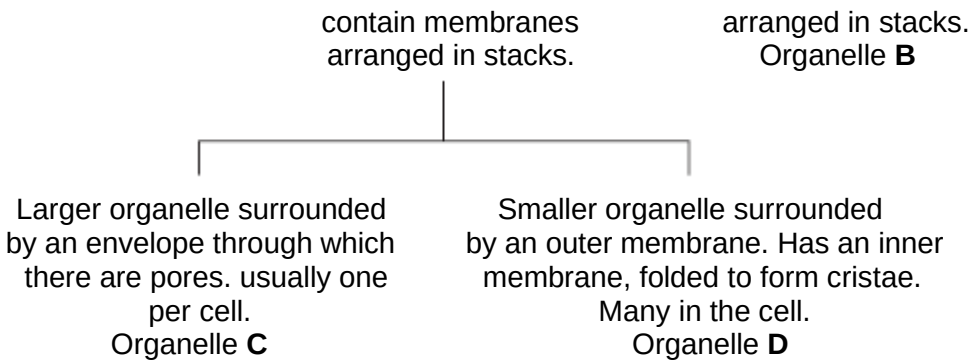
_____

_____ **(2)**

(Total 8 marks)

Q18. The diagram shows how some organelles may be distinguished from each other.





(a) (i) Name organelle **B**.

_____ **(1)**

(ii) Describe the function of organelle **B**.

_____

_____

_____

_____ **(2)**

(b) Which of organelles **A**, **B**, **C** or **D**

(i) is a ribosome;

_____ **(1)**

(ii) contains most of the DNA found in a plant cell?

_____ **(1)**

(c) Some liver tissue was ground, filtered and centrifuged to make a suspension of organelle **D**.

(i) Explain why the solution in which the liver tissue was ground should be ice-cold.

_____

_____ **(1)**

(ii) The ground liver was centrifuged at low speed. The pellet that formed at the bottom of the centrifuge tube was thrown away and the supernatant centrifuged again at higher speed. Explain why it was necessary to first centrifuge the ground liver at low speed in order to obtain a suspension of organelle **D**.

_____

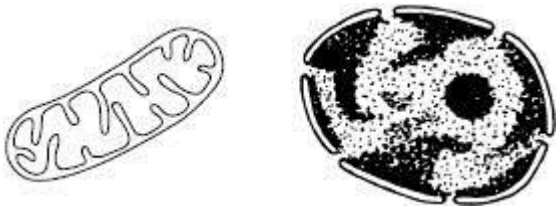
_____

_____

_____ **(2)**

(Total 8 marks)

Q19. (a) The diagram shows two organelles found in a eukaryotic cell.



A **B**

(i) Name the organelles.

A _____

B _____ **(1)**

(ii) Explain how the inner membrane is adapted to its function in organelle **A**.

_____

_____

_____

_____ **(2)**

(b) Give **one** feature of a prokaryotic cell that is not found in a eukaryotic cell.

_____ **(1)**

(c) Describe how a sample consisting only of chloroplasts could be obtained from homogenised plant tissue.

_____

_____

_____

_____

_____

_____ **(3)**

(Total 7 marks)

Q20. (a) Describe how you could use cell fractionation to isolate chloroplasts from leaf tissue.

_____

_____

_____

_____

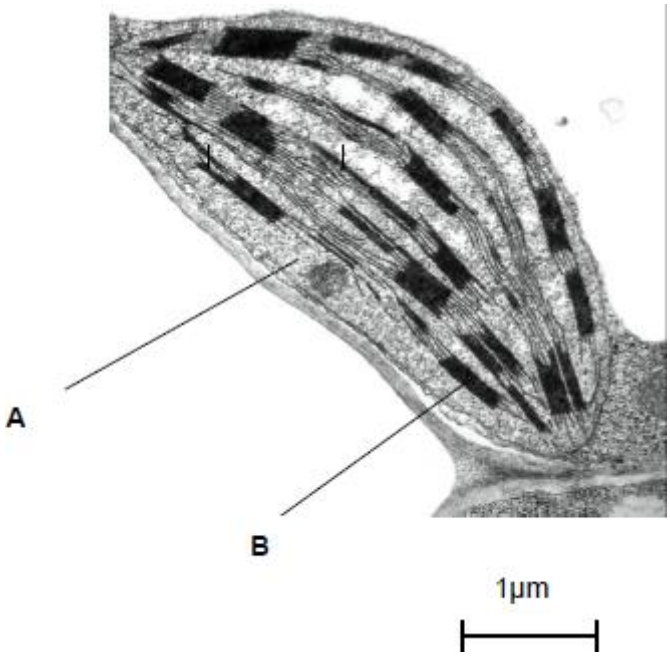
_____

_____

(Extra space) _____

_____ **(3)**

The figure below shows a photograph of a chloroplast taken with an electron microscope.



(b) Name the parts of the chloroplast labelled **A** and **B**.

Name of **A** _____

Name of **B** _____ **(2)**

(c) Calculate the length of the chloroplast shown in the figure above.

Answer _____

(1)

(d) Name **two** structures in a eukaryotic cell that **cannot** be identified using an optical microscope.

1. _____

2. _____ **(1)**

(Total 7 marks)