EXAM PAPERS PRACTICE

Cell structure 1

Level: CIE A Level 9700
Subject: Biology
Exam Board: Suitable for all boards
Topic: Cell structure 1
Type: Questionnaire

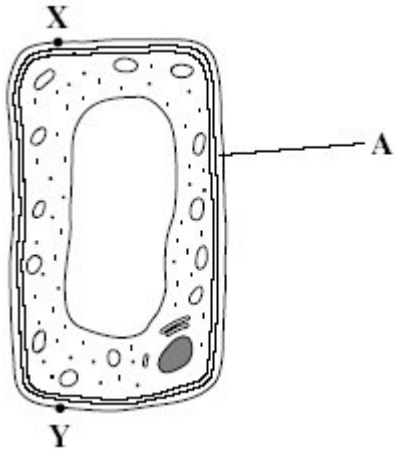
To be used by all students preparing for CIE Biology A Level 9700 foundation or higher tier but also suitable for students of other boards.

1 (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.

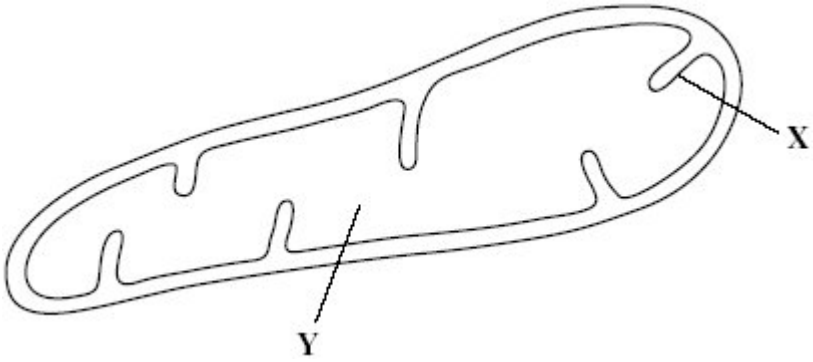
_____

_____

(1)

(Total 5 marks)

2 The diagram shows a mitochondrion.



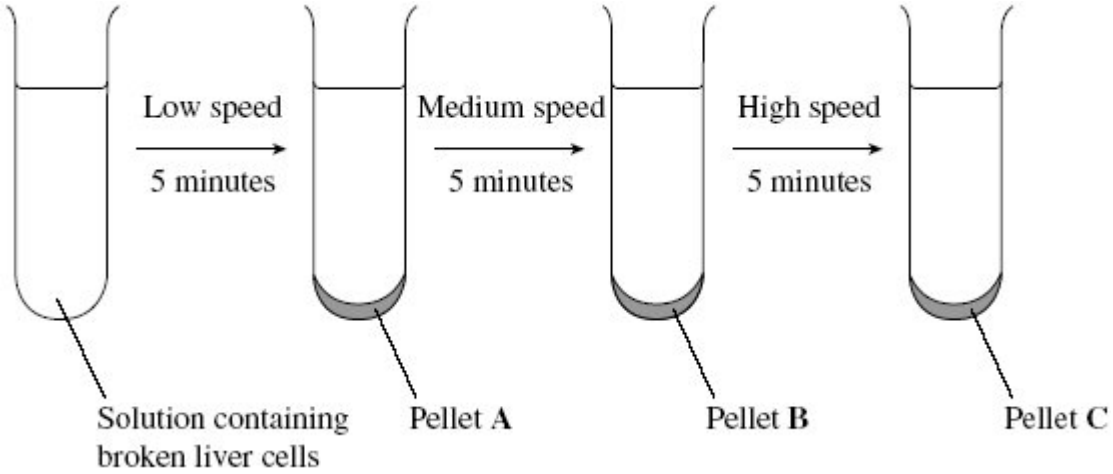
(a) Name the parts labelled **X** and **Y**.

(i) **X** _____

(ii) **Y** _____

(2)

Scientists isolated mitochondria from liver cells. They broke the cells open in an ice-cold, isotonic solution. They then used a centrifuge to separate the cell organelles. The diagram shows some of the steps in the process of centrifugation.



(b) Suggest which pellet, **A**, **B** or **C** contained the mitochondria.

(1)

(c) Explain why the solution used was

(i) ice-cold

_____

_____

(1)

(ii) isotonic.

_____

_____

_____

_____

(2)

(d) People with mitochondrial disease have mitochondria that do not function properly.

Some people with mitochondrial disease can only exercise for a short time. Explain why a person with mitochondrial disease can only exercise for a short time.

_____

_____

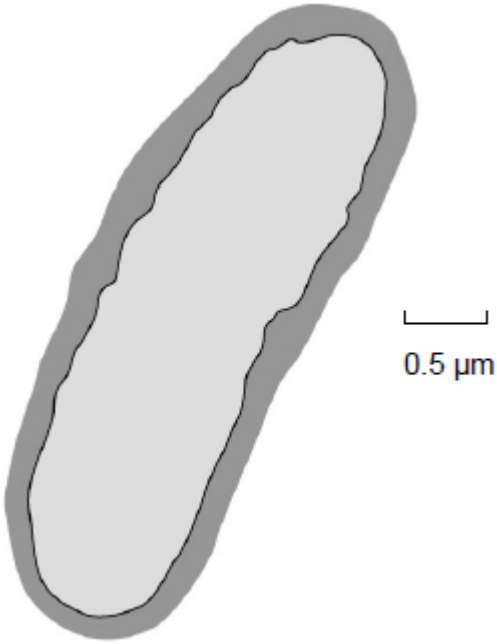
_____

_____

(2)

(Total 8 marks)

3 A bacterium is shown in the diagram.



(a) Calculate the magnification of the image.

Magnification = _____

(1)

(b) Complete the table to show the features of a bacterium and a virus.

Put a tick (✓) in the box if the feature is shown.

Surface	Bacterium	Virus
Cell-surface membrane		
Nucleus		
Cytoplasm		
Capsid		

(2)

(c) DNA and RNA can be found in bacteria.

Give **two** ways in which the nucleotides in DNA are different from the nucleotides in RNA.

1. _____

2. _____

(2)

(Total 5 marks)

4 Starch and cellulose are two important plant polysaccharides.

The following diagram shows part of a starch molecule and part of a cellulose molecule.

Starch

Cellulose

(a) Explain the difference in the structure of the starch molecule and the cellulose molecule shown in the diagram above.

_____

_____

_____

_____

(2)

(b) Starch molecules and cellulose molecules have different functions in plant cells. Each molecule is adapted for its function.

Explain **one** way in which starch molecules are adapted for their function in plant cells.

_____

_____

_____

_____

(2)

(c) Explain how cellulose molecules are adapted for their function in plant cells.

(Extra space)

(3)

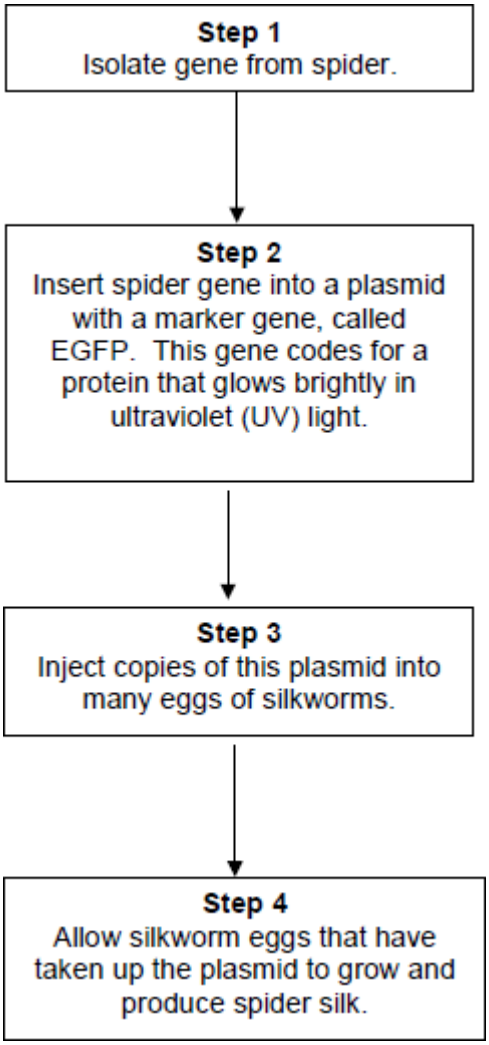
(Total 7 marks)

5 Silkworms secrete silk fibres, which are harvested and used to manufacture silk fabric.

Scientists have produced genetically modified (GM) silkworms that contain a gene from a spider.

The GM silkworms secrete fibres made of spider web protein (spider silk), which is stronger than normal silk fibre protein.

The method the scientists used is shown in the figure below.



(a) Suggest why the plasmids were injected into the eggs of silkworms, rather than into the silkworms.

_____

_____

_____

_____

(2)

(b) Suggest why the scientists used a marker gene and why they used the EGFP gene.

_____

_____

_____

_____

(2)

The scientists ensured the spider gene was expressed only in cells within the silk glands.

(c) What would the scientists have inserted into the plasmid along with the spider gene to ensure that the spider gene was only expressed in the silk glands of the silkworms?

_____

(1)

(d) Suggest **two** reasons why it was important that the spider gene was expressed only in the silk glands of the silkworms.

1. _____

_____

2. _____

_____

(2)

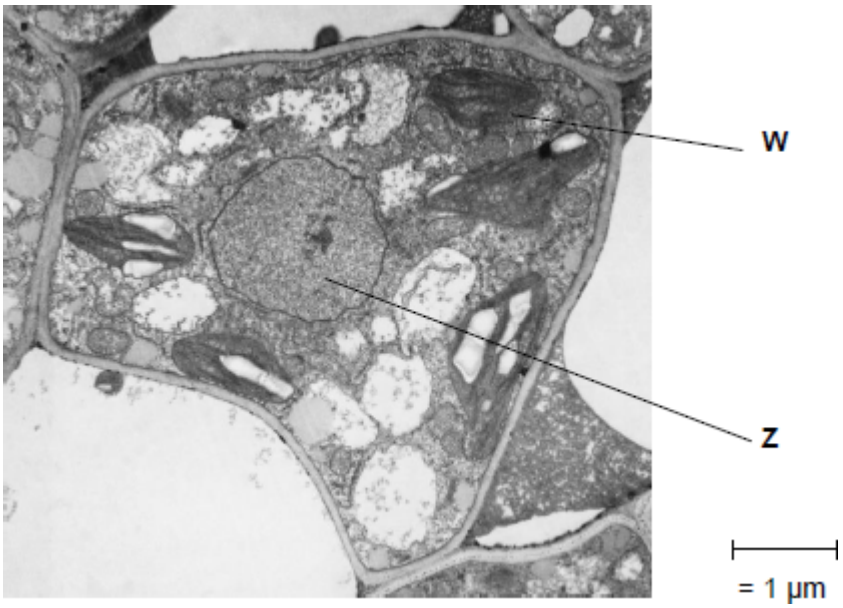
(Total 7 marks)

6 (a) Describe how you could make a temporary mount of a piece of plant tissue to observe the position of starch grains in the cells when using an optical (light) microscope.

(Extra space) _____

(4)

The figure below shows a microscopic image of a plant cell.



(b) Give the name and function of the structures labelled **W** and **Z**.

Name of **W** _____

Function of **W** _____

Name of **Z** _____

Function of **Z** _____

(2)

(c) A transmission electron microscope was used to produce the image in the figure above. Explain why.

_____

_____

_____

_____

_____

(2)

(d) Calculate the magnification of the image shown in the figure in part (a).

Answer = _____

(1)

(Total 9 marks)

7 (a) The table below shows features of a bacterium and the human immunodeficiency virus (HIV) particle.

Complete the table by putting a tick (✓) where a feature is present.

Feature	**Bacterium**	**Human immunodeficiency virus (HIV) particle**
RNA		
Cell wall		
Enzyme molecules		
Capsid		

(2)

(b) When HIV infects a human cell, the following events occur.

- A single-stranded length of HIV DNA is made.
- The human cell then makes a complementary strand to the HIV DNA.

The complementary strand is made in the same way as a new complementary strand is made during semi-conservative replication of human DNA.

Describe how the complementary strand of HIV DNA is made.

(3)

(c) Contrast the structures of DNA and mRNA molecules to give **three** differences.

1. _____

2. _____

3. _____

(3)

(Total 8 marks)

8 Cells constantly hydrolyse ATP to provide energy.

(a) Describe how ATP is resynthesised in cells.

_____

_____

_____

_____

(2)

(b) Give **two** ways in which the hydrolysis of ATP is used in cells.

1. _____

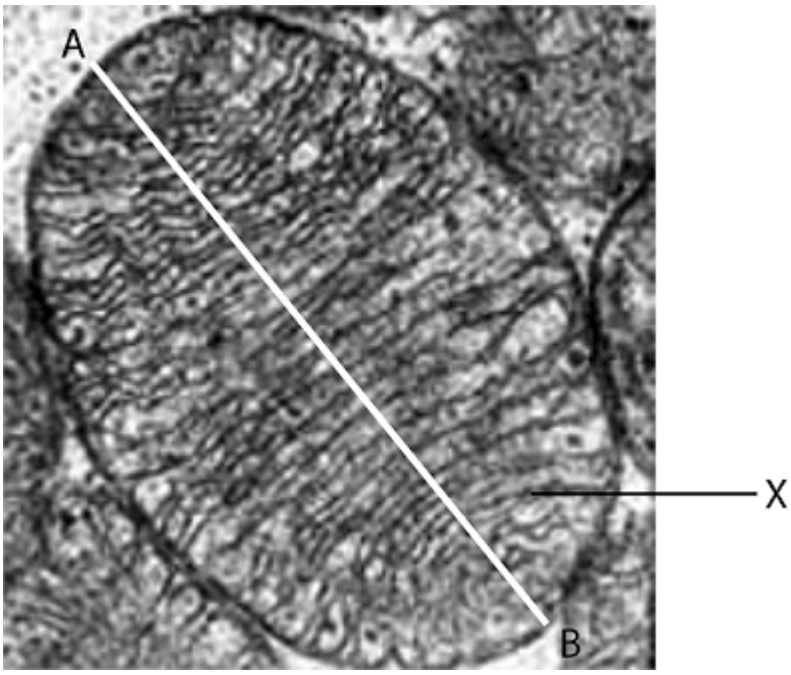
_____

2. _____

_____

(2)

(c) This is a photograph (micrograph) of a mitochondrion taken using a scanning electron microscope.



What is the evidence that a scanning electron microscope was used to take this photograph?

_____

_____

_____

(1)

(d) Name the part of the mitochondrion labelled **X** in the photograph.

_____

(1)

(e) The actual length of the mitochondrion between points **A** and **B** in the photograph is 4 μm.

What is the magnification of the mitochondrion in the photograph?

Show your working.

Magnification _____

(2)

(Total 8 marks)

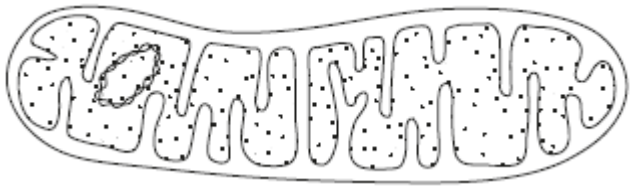
9 (a) The table shows some parts of cells and two different types of cell.

Complete the table by putting a tick in a box if the structure is present in the type of cell.

	Cell wall	**Cell-surface membrane**	**Nucleus**
White blood cell			
Bacterial cell			

(2)

(b) The diagram is of a mitochondrion at a magnification of × 30 000.



Calculate the actual length of this mitochondrion in micrometres (µm). Show your working.

Answer = _____ µm

(2)

(c) Some scientists support the theory that mitochondria are organelles that evolved from prokaryotic cells.

(i) Give **one** piece of evidence that supports the theory that mitochondria evolved from prokaryotic cells.

_____

_____

_____

(1)

(ii) What is the advantage to cells of having mitochondria?

_____

_____

_____

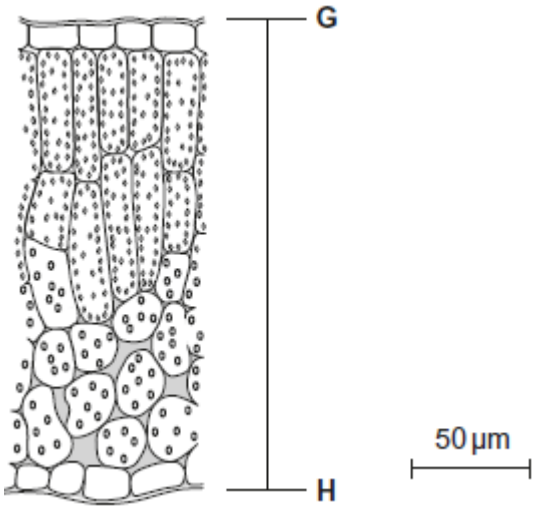
_____

_____

(2)

(Total 7 marks)

10 A scientist examined the structure of mustard plant leaves. He viewed temporary mounts of leaf tissues with an optical microscope. The figure below shows a drawing of typical results.



(a) Describe how temporary mounts are made.

_____

_____

_____

_____

_____

(2)

(b) Calculate the distance in micrometres between **G** and **H** on the leaf.

Answer = _____ µm

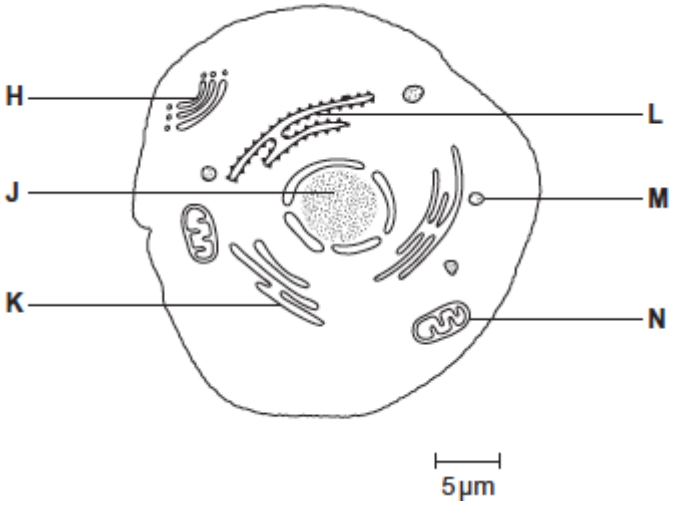
(2)

(c) Describe how the scientist could have used the temporary mounts of leaves to determine the mean number of chloroplasts in mesophyll cells of a leaf.

(3)

(Total 7 marks)

11 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)

12 A stomach ulcer is caused by damage to the cells of the stomach lining. People with stomach ulcers often have the bacterium *Helicobacter pylori* in their stomachs.

A group of scientists was interested in trying to determine how infection by *H. pylori* results in the formation of stomach ulcers.

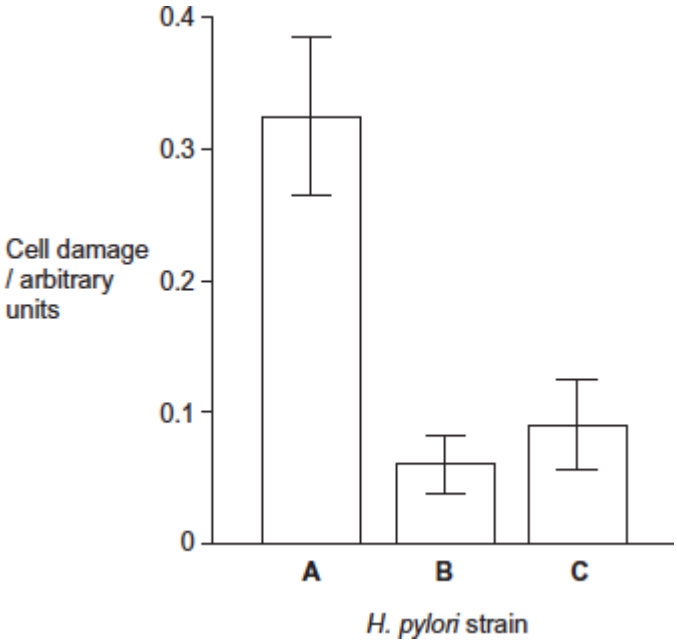
The scientists grew different strains of *H. pylori* in liquid culture.

The table below shows the substances released by each of these strains.

***H. pylori* strain**	**Substances released by the *H. pylori* cells**	
	Toxin	**Enzyme that neutralises acid**
A	✓	✓
B	✗	✓
C	✓	✗

The scientists centrifuged the cultures of each strain to obtain cell-free liquids. They added each liquid to a culture of human cells. They then recorded the amount of damage to the human cells.

Their results are shown below. The error bars show ± 1 standard deviation.



(a) Describe and explain how centrifuging the culture allowed the scientists to obtain a cell-free liquid.

[Extra space]

(3)

(b) The scientists measured cell damage by measuring the activity of lysosomes.
Give **one** function of lysosomes.

(1)

(c) *H. pylori* cells produce an enzyme that neutralises acid.
Suggest **one** advantage to the *H. pylori* of producing this enzyme.

(2)

(d) What do these data suggest about the damage caused to human cells by the toxin and by the enzyme that neutralises acid?
Explain your answer.

[Extra space]

(3)

(e) The scientists carried out a further investigation. They treated the liquid from **strain A** with a protein-digesting enzyme before adding it to a culture of human cells. No cell damage was recorded.
Suggest why there was no damage to the cells.

[Extra space]

(3)

(Total 12 marks)

13 (a) Describe how phospholipids are arranged in a plasma membrane.

(2)

(b) Cells that secrete enzymes contain a lot of rough endoplasmic reticulum (RER) and a large Golgi apparatus.

(i) Describe how the RER is involved in the production of enzymes.

(2)

(ii) Describe how the Golgi apparatus is involved in the secretion of enzymes.

_____

_____

_____

(1)

(Total 5 marks)

14 (a) Describe how bacteria are destroyed by phagocytes.

_____

_____

_____

_____

_____

_____

*(Extra space)*_____

_____

_____

(3)

(b) Give **two** structures a bacterial cell may have that a white blood cell does not have.

1. _____

_____

2. _____

_____

(2)

(Total 5 marks)

15 Read the following passage.

Whooping cough is caused by the bacterium *Bordetella pertussis*. The first vaccines for whooping cough contained whole bacterial cells that had been heated for several minutes. Today, most vaccines only contain between one and three parts of the bacterial cells. People given whole-cell vaccines were more likely to develop harmful side effects than the people given the vaccines containing parts of the bacterial cells. Those given whole-cell vaccines produced a greater range of antibodies against the bacterium.

There have been suggestions that whooping cough vaccines may not work very well. These suggestions are due to recent reports of large rises in the number of cases of whooping cough. Doctors who examined a group of patients with coughs diagnosed about 17% of them as having whooping cough. Scientists tested the blood of the same group of patients for antibodies against a toxin produced by *Bordetella pertussis*. They concluded that 4% of this group actually had whooping cough.

Use the information in the passage and your own knowledge to answer the following questions.

(a) (i) People given whole-cell vaccines were more likely to develop harmful side effects than the people given the vaccines containing parts of the bacterial cells (lines 4–6).

Suggest reasons why.

_____

_____

_____

_____

_____

_____

*(Extra space)*_____

_____

_____

(3)

(ii) People given whole-cell vaccines produced a greater range of antibodies against the bacterium than the people given the vaccines containing parts of the bacterial cells (lines 7–8).

Explain why.

_____

_____

_____

_____

(2)

(b) The scientists concluded from their test that 4% of patients with long-term coughs actually had whooping cough (line 15).

Explain how they used the results of their test to reach this conclusion.

_____

_____

_____

_____

_____

_____

*(Extra space)*_____

_____

_____

(3)

(c) What does the scientists' work suggest about reports of large rises in the number of cases of whooping cough (lines 10–11)?

Explain your answer.

_____

_____

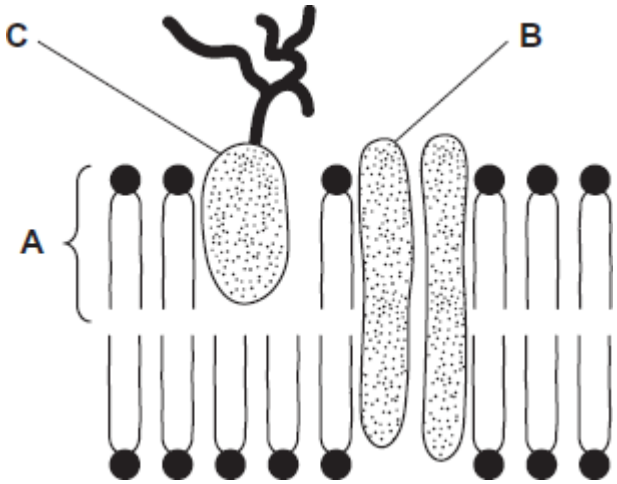
_____

_____

(2)

(Total 10 marks)

16 The diagram shows the structure of the cell-surface membrane of a cell.



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

A _____

B _____

(2)

(b) (i) **C** is a protein with a carbohydrate attached to it. This carbohydrate is formed by joining monosaccharides together. Name the type of reaction that joins monosaccharides together.

Name the type of reaction that joins monosaccharides together.

_____

(1)

(ii) Some cells lining the bronchi of the lungs secrete large amounts of mucus. Mucus contains protein.

Name **one** organelle that you would expect to find in large numbers in a mucus-secreting cell and describe its role in the production of mucus.

Organelle _____

Description of role _____

_____

_____

_____

(2)

(Total 5 marks)

17 Read the following passage.

Microfold cells are found in the epithelium of the small intestine. Unlike other epithelial cells in the small intestine, microfold cells do not have adaptations for the absorption of food.

Microfold cells help to protect against pathogens that enter the intestine. They have receptor proteins on their cell-surface membranes that bind to antigens on the surface of pathogens. The microfold cells take up the antigens and transport them to cells of the immune system. Antibodies are then produced which give protection against the pathogen.

Scientists believe that it may be possible to develop vaccines that make use of microfold cells. These vaccines could be swallowed in tablet form.

Use information from the passage and your own knowledge to answer the following questions.

(a) (i) Microfold cells have receptor proteins on their cell-surface membranes that bind to antigens (line 5). What is an antigen?

_____

_____

_____

(1)

(ii) Microfold cells take up the antigens and transport them to cells of the immune system (lines 6-7). Antigens are not able to pass through the cell-surface membranes of other epithelial cells. Suggest **two** reasons why.

_____

_____

_____

_____

_____

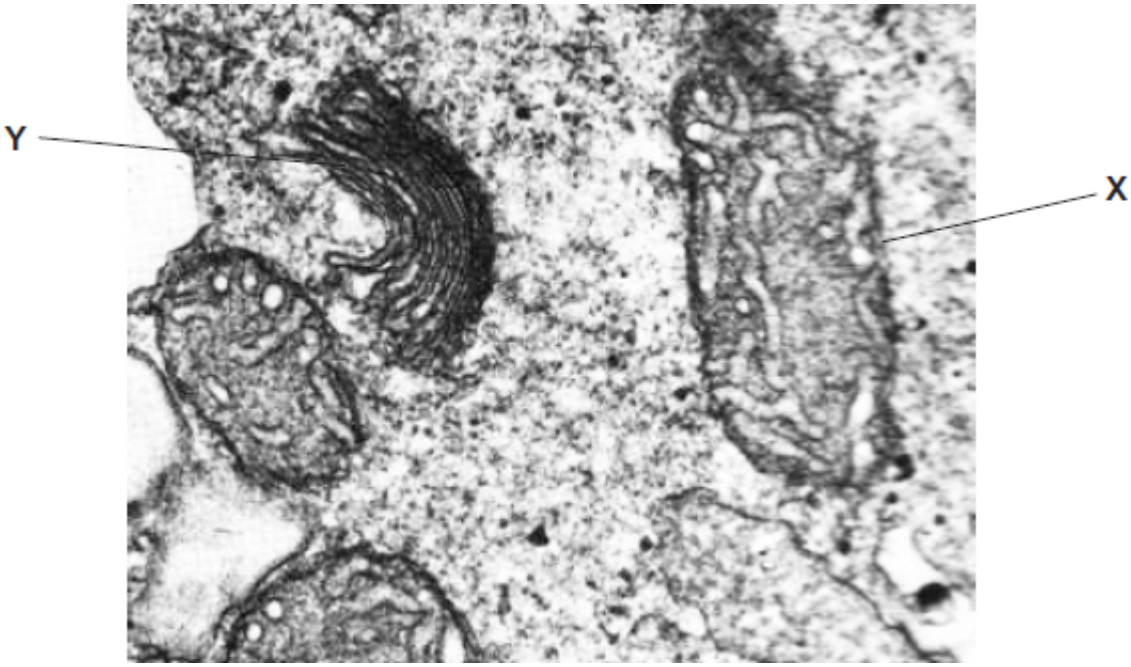
(2)

(b) Scientists believe that it may be possible to develop vaccines that make use of microfold cells (lines 9-10). Explain how this sort of vaccine would lead to a person developing immunity to a pathogen.

(5)

(Total 8 marks)

18 The photograph shows part of the cytoplasm of a cell.



(a) (i) Organelle **X** is a mitochondrion.

What is the function of this organelle?

_____

_____

(1)

(ii) Name organelle **Y.**

_____

(1)

(b) This photograph was taken using a transmission electron microscope. The structure of the organelles visible in the photograph could not have been seen using an optical(light) microscope. Explain why.

_____

_____

_____

_____

_____

(2)

(Total 4 marks)

19 (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 _____

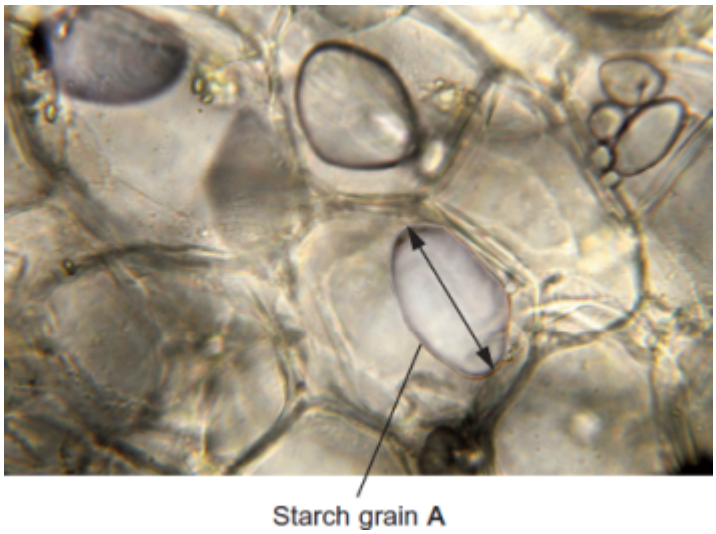
Explanation _____

_____

_____

(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.

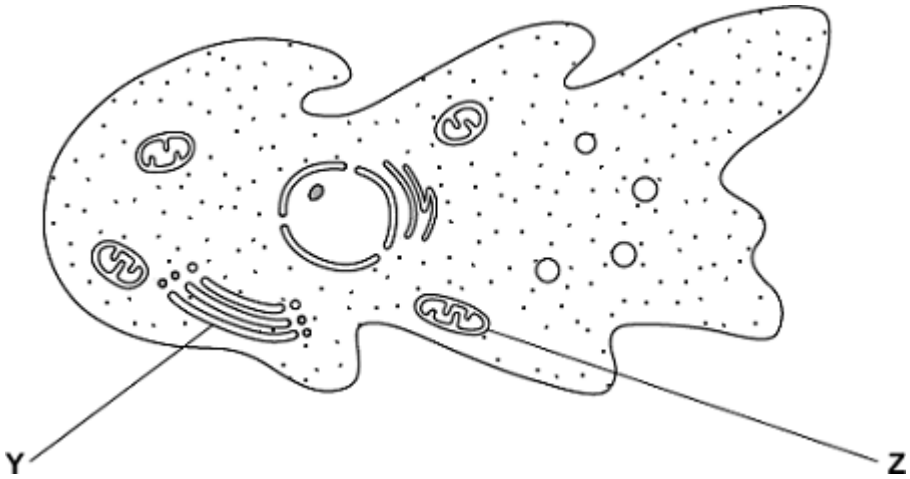


Magnification _____ times

(2)

(Total 8 marks)

20 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**?

_____

_____

_____

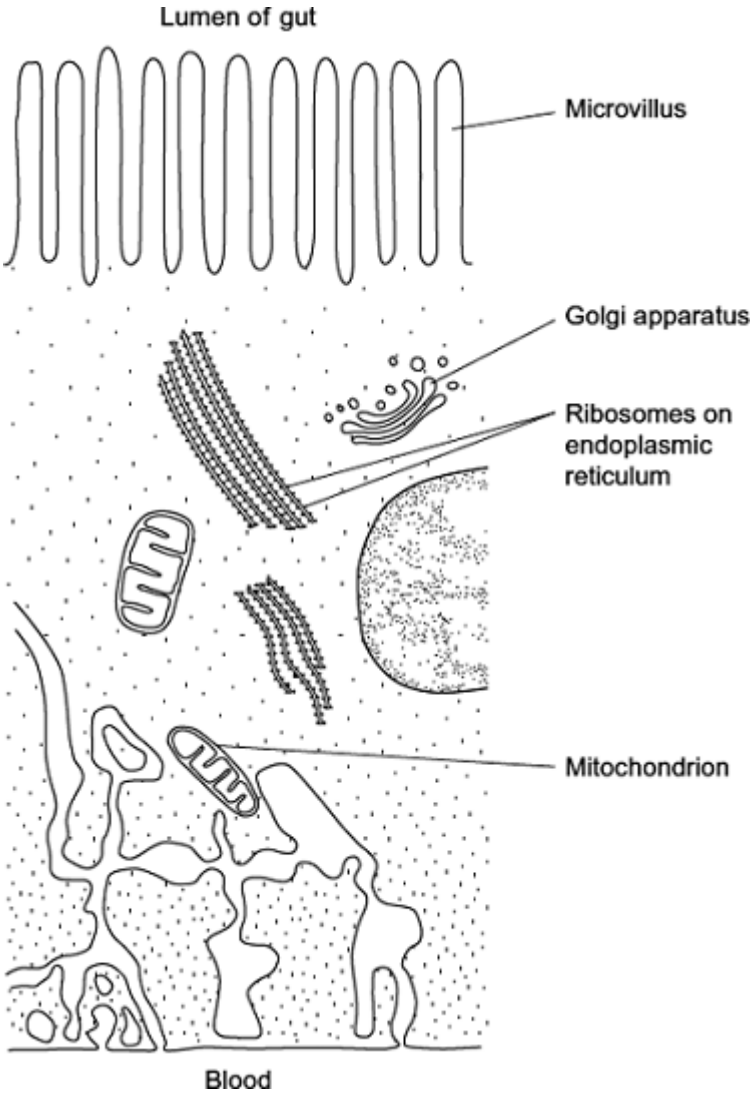
(1)

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

(2)

(Total 6 marks)

21 The diagram shows part of an epithelial cell from an insect's gut.



This cell is adapted for the three functions listed below. Use the diagram to explain how this cell is adapted for each of these functions.

Use a **different** feature in the diagram for each of your answers.

(a) the active transport of substances from the cell into the blood

(2)

(b) the synthesis of enzymes

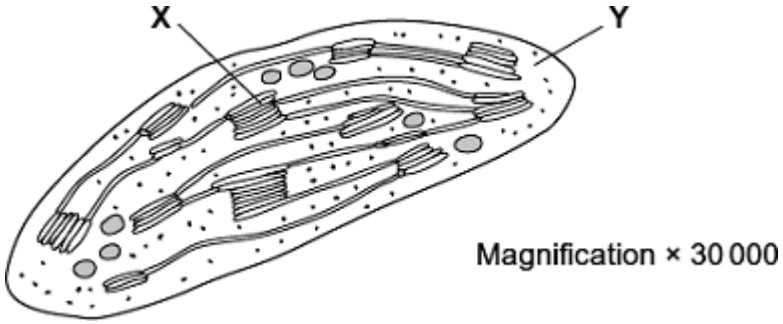
(2)

(c) rapid diffusion of substances from the lumen of the gut into the cytoplasm

(1)

(Total 5 marks)

22 The diagram shows a chloroplast as seen with an electron microscope.



(a) Name **X** and **Y**.

X _____

Y _____

(2)

(b) Describe the function of a chloroplast.

(2)

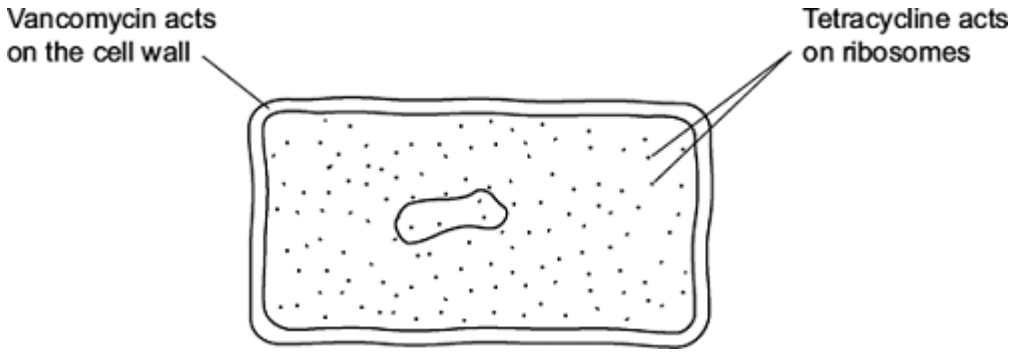
(c) Calculate the maximum length of this chloroplast in micrometres (μm). Show your working.

Answer _____ μm

(2)

(Total 6 marks)

23 The diagram shows the structure of a bacterium and the sites of action of two antibiotics.



(a) (i) Use information in the diagram to explain why vancomycin does **not** affect human cells.

_____

_____

(1)

(ii) Use information in the diagram to explain how tetracycline prevents bacterial growth.

_____

_____

(1)

(b) Frequent treatment with vancomycin can result in resistant strains of bacteria. Explain how.

_____

_____

_____

_____

_____

_____

*(Extra space)*_____

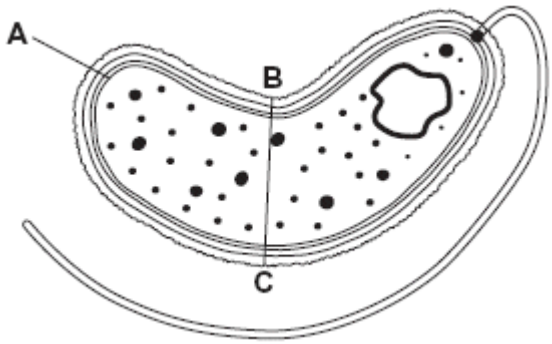
_____

_____

(2)

(Total 4 marks)

24 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.

_____

_____

_____

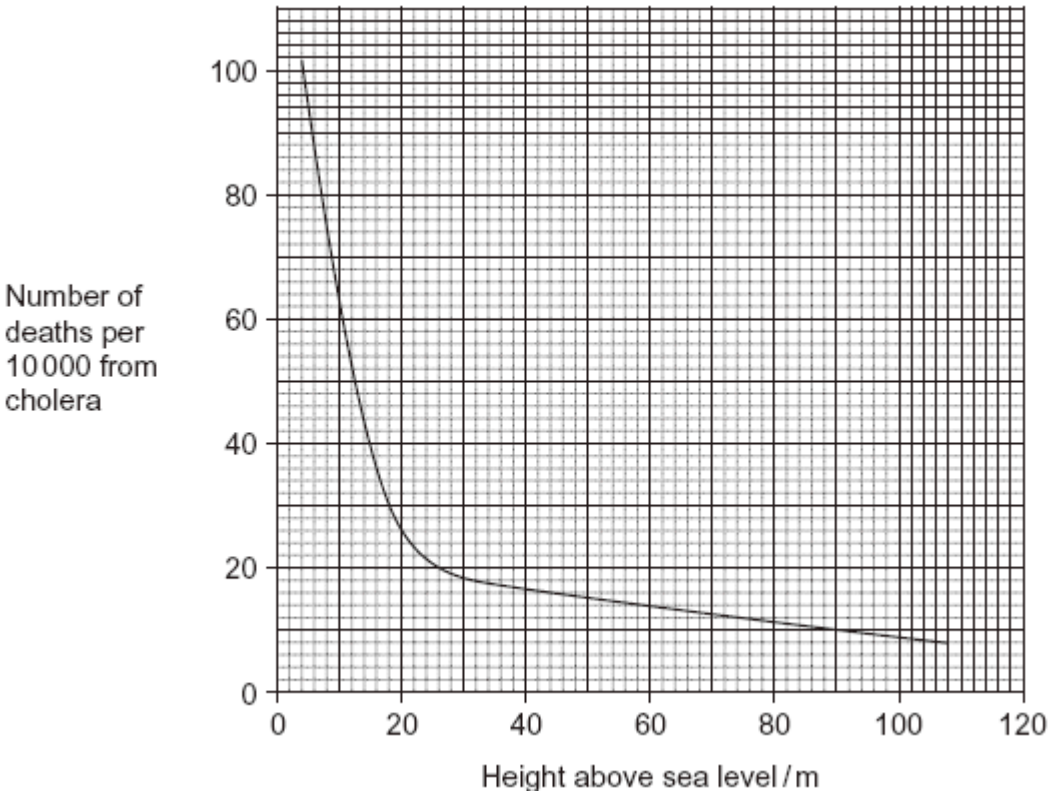
(1)

(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.

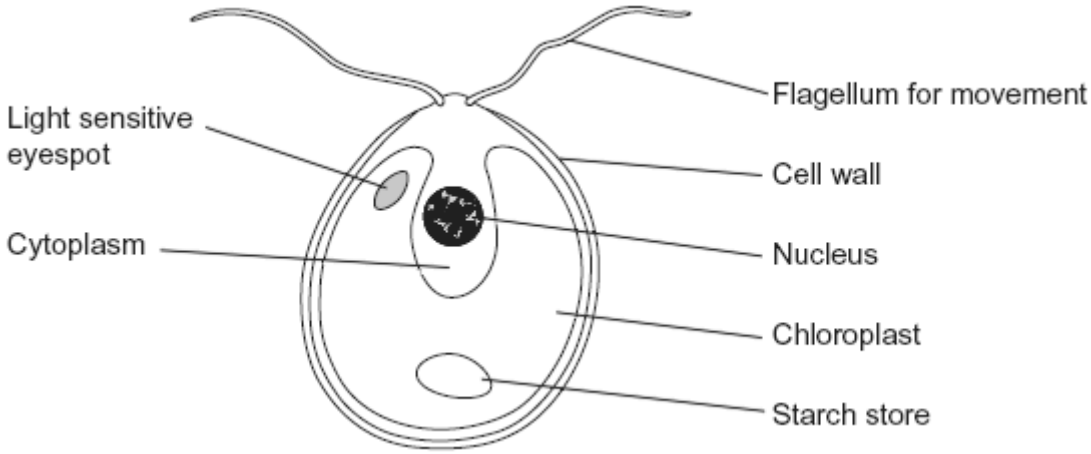


Describe the relationship between the number of deaths from cholera and the height at which people lived above sea level.

(2)

(Total 9 marks)

25 The diagram shows an organism called *Chlamydomonas*.



(a) Name **two** structures shown in the diagram that are present in plant cells but are **not** present in animal cells.

1. _____

_____

2. _____

_____

(2)

(b) *Chlamydomonas* lives in fresh water ponds. Use your knowledge of osmosis to suggest an advantage of using starch as a carbohydrate store.

_____

_____

_____

_____

_____

(2)

(c) *Chlamydomonas* has adaptations that help it to maintain a high rate of photosynthesis.

Use information in the diagram to explain what these adaptations are.

_____

_____

_____

_____

_____

*(Extra space)*_____

_____

_____

(3)

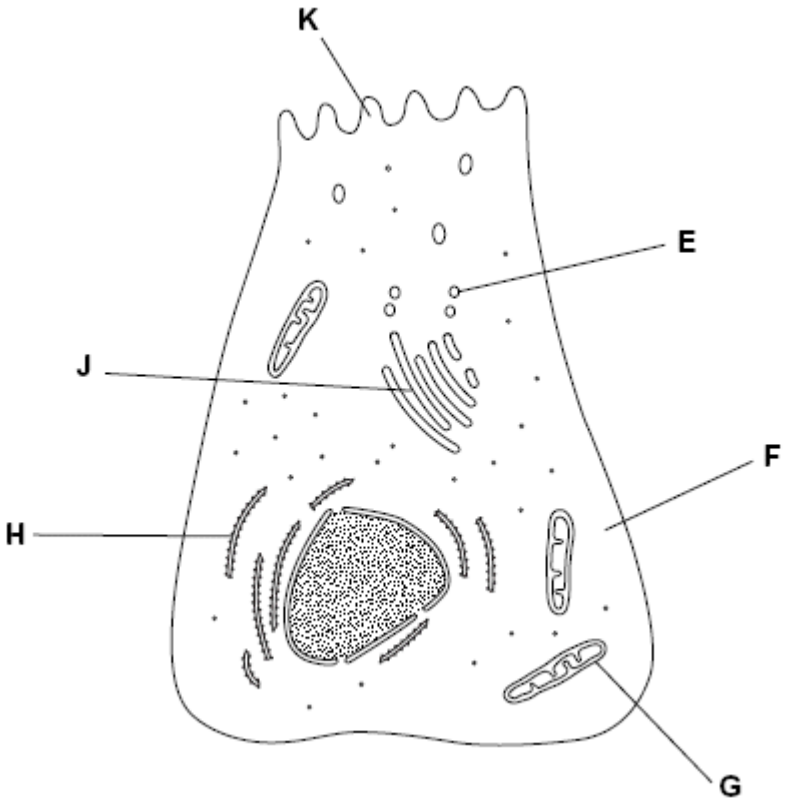
(Total 7 marks)

26 (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.

_____

_____

_____

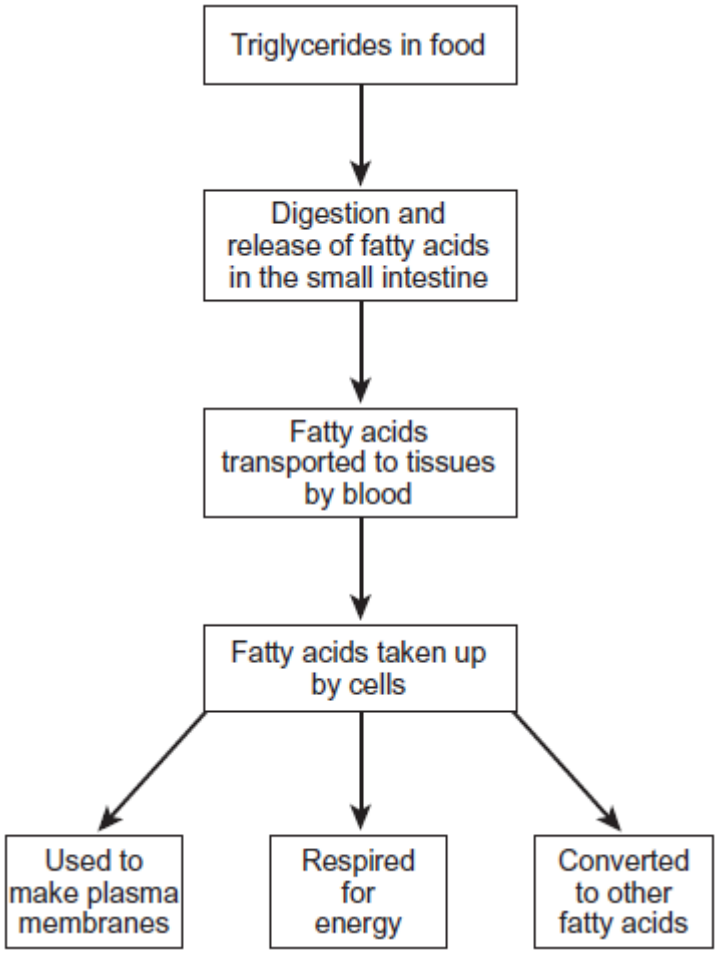
_____

(2)

(Total 10 marks)

27 Triglycerides are taken into the body as part of a balanced diet. These triglycerides contain fatty acids including omega-3 fatty acids. It has been discovered that omega-3 fatty acids are associated with health benefits. The benefits include faster development of nerve cells and clearer vision. Omega-3 fatty acids are also associated with protection from heart disease, arthritis and cancer.

The following figure shows how omega-3 and other fatty acids are taken in and used by the bodies of animals including humans.



Use the information in the figure to explain **two** ways in which fatty acids are important in the formation of new cells.

1. _____

_____

_____

_____

2. _____

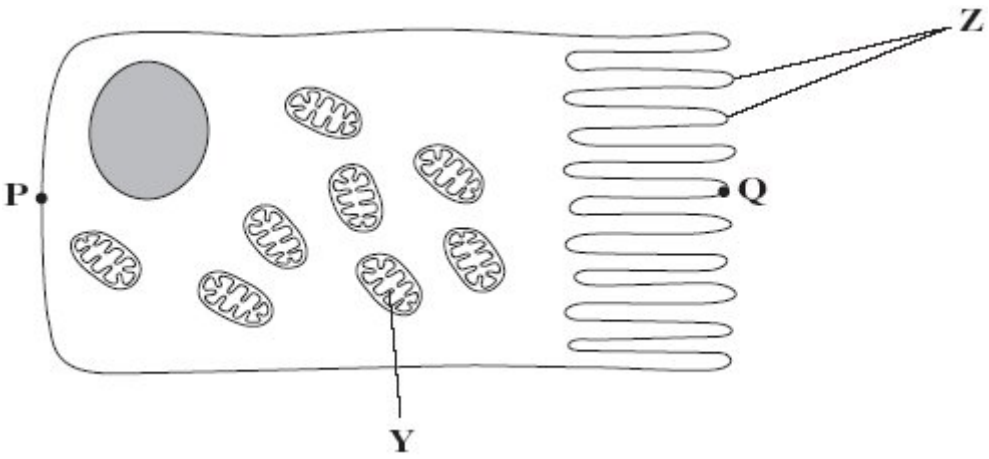
_____

_____

_____

(Total 4 marks)

28 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.

_____

_____

_____

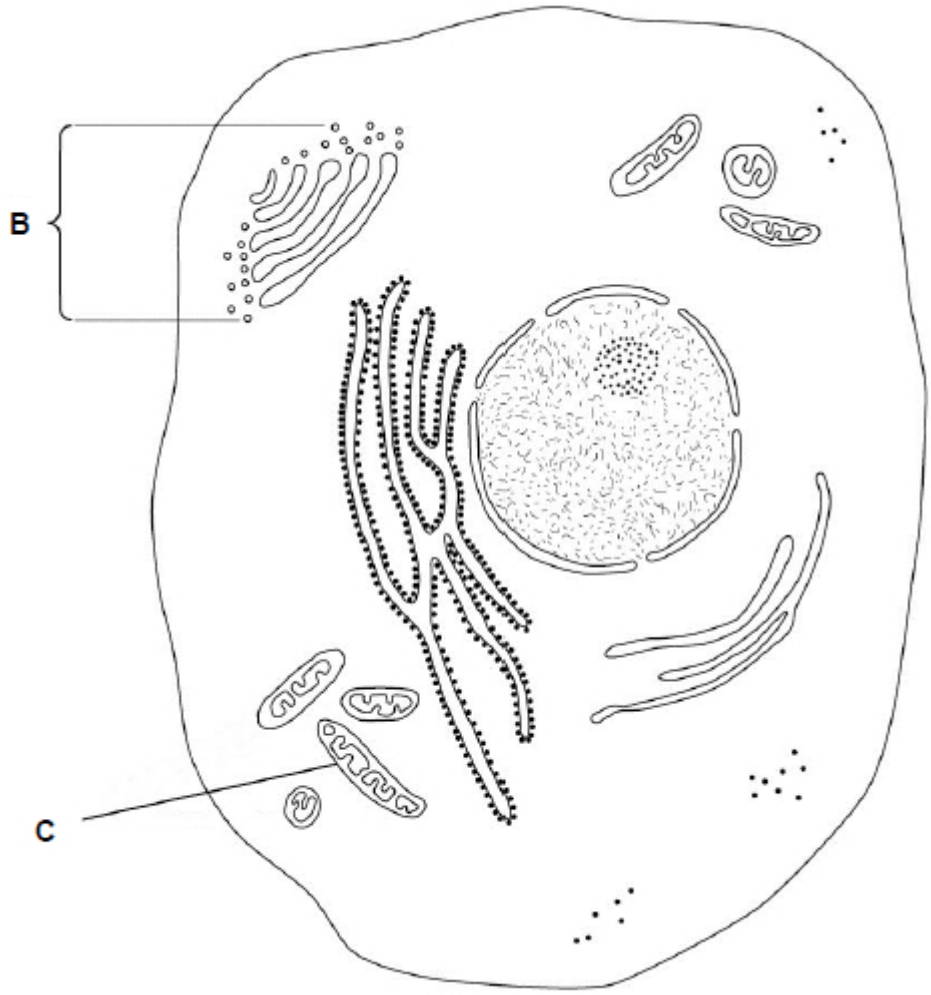
_____

_____

(2)

(Total 7 marks)

29 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)

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

_____

_____

_____

_____

_____

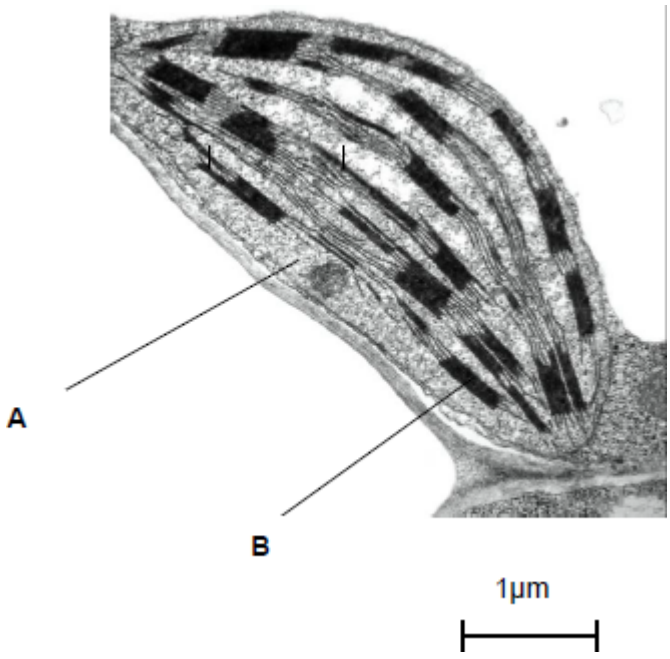
_____

(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)