Cell structure

(Past Year Topical Questions 2010-2015)

May/June 2010 (21)

2 Fig. 2.1 is a section of an alveolus and surrounding tissue.

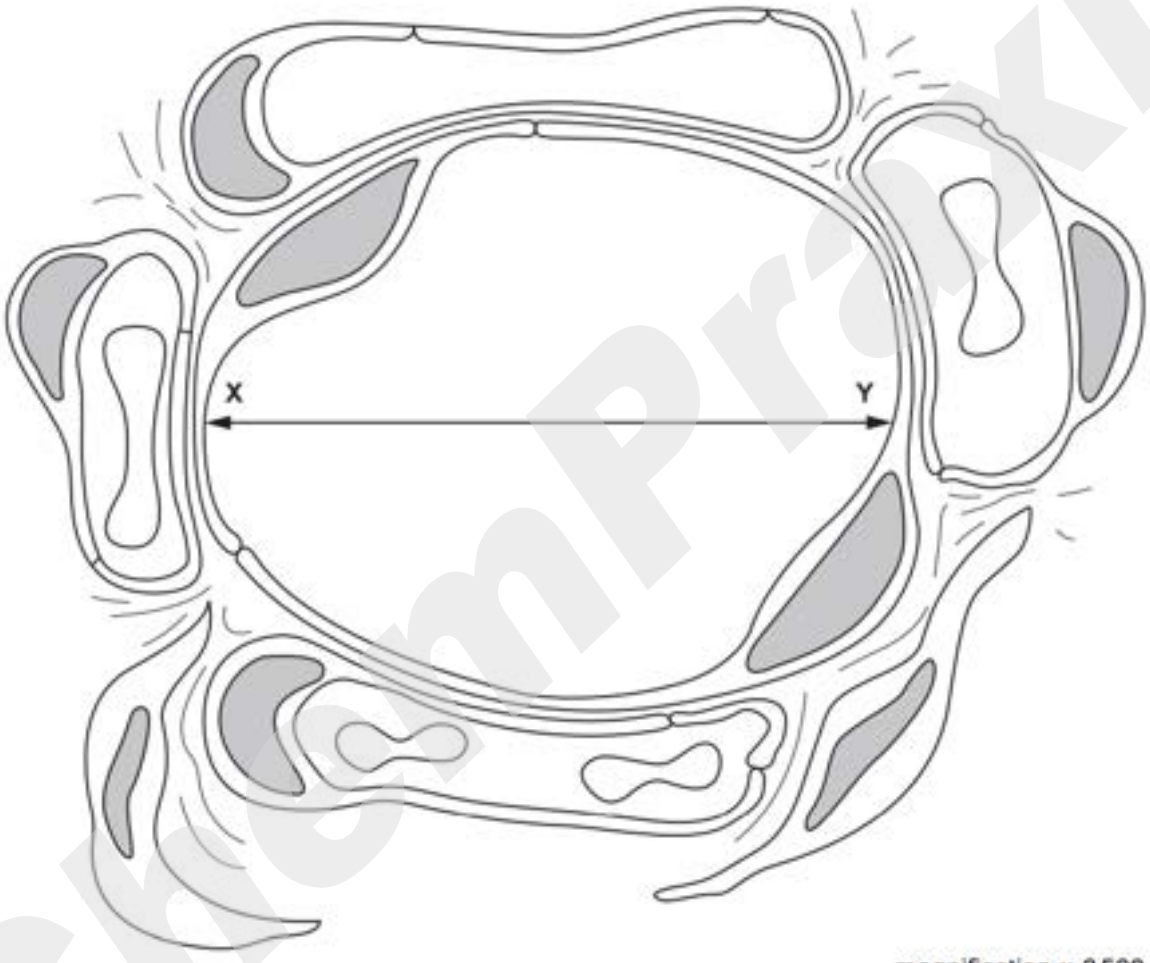

Fig. 2.1

(a) Calculate the actual diameter of the alveolus along the line **X**–**Y**.

Show your working and give your answer to the nearest micrometre.

Answer = ... µm [2]

May/June 2010 (22)

1 Fig. 1.1 is a diagram of an electron micrograph of a plant cell.
Fig. 1.2 is a diagram of an electron micrograph of an animal cell.
Both diagrams are incomplete.

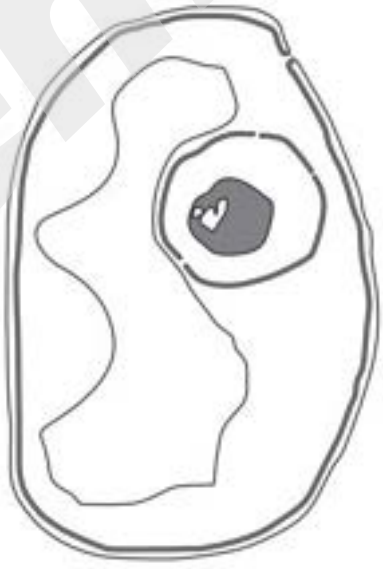

Fig. 1.1

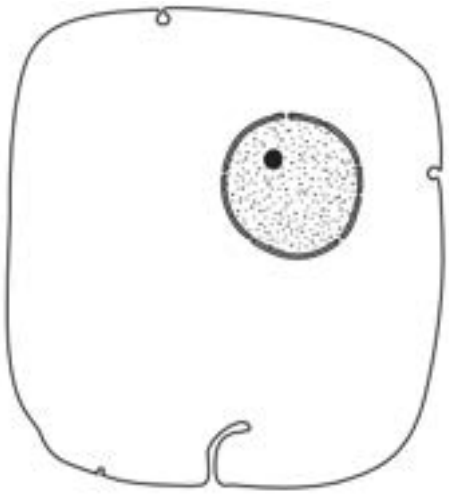

Fig. 1.2

(a) Explain how Fig. 1.1 can be identified as a plant cell.

.....

.....

.....

.....[2]

(b) Some organelles are missing from Figs 1.1 and 1.2. Information about these organelles is shown in the shaded boxes in Table 1.1.

Complete the empty boxes in Table 1.1 by adding the correct information below each column heading.

Table 1.1

name of organelle	diagram of organelle(s) as seen under the electron microscope (not to scale)	one function of organelle	cell type(s) in which organelle is located
mitochondrion			animal and plant
		assemble microtubules to produce the mitotic spindle	
rough endoplasmic reticulum		protein synthesis	
Golgi apparatus			animal and plant
		photosynthesis	plant only

[8]

May/June 2010 (23)

1 Fig. 1.1 shows part of an animal cell viewed with an electron microscope.

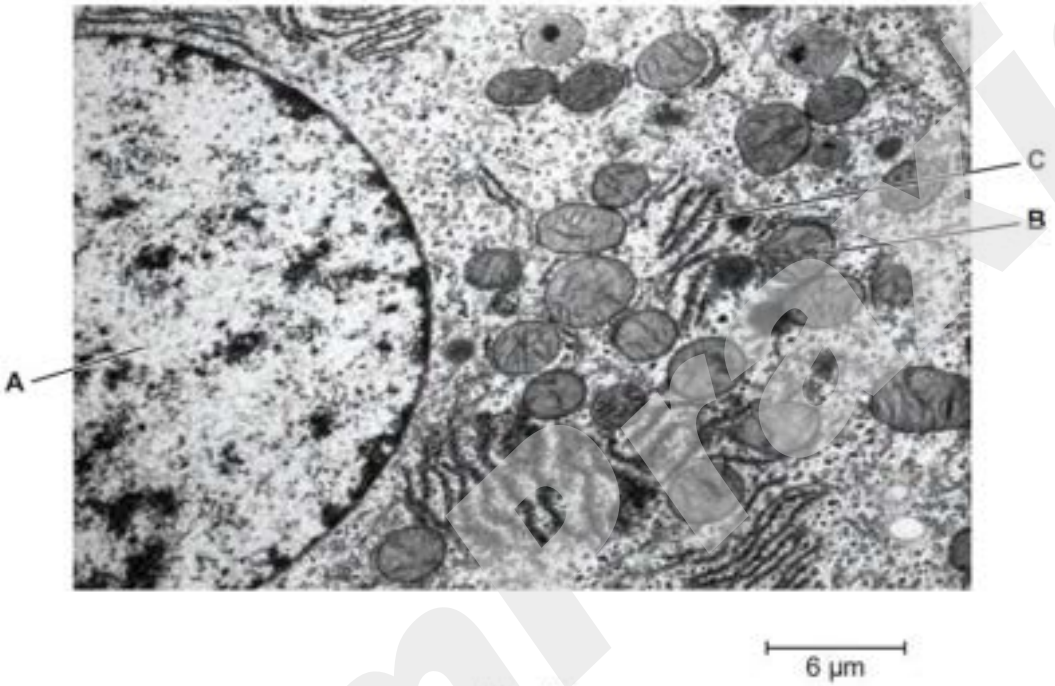

Fig. 1.1

(a) Name the structures A to C.

A .....

B .....

C .....[3]

(b) (i) State the function of structure C.

.....[1]

(ii) Explain why structure **C** cannot be seen using a light microscope.

.....

.....

.....

.....[2]

(c) Suggest **one** disadvantage of the electron microscope compared to the light microscope for the study of cells.

.....

.....[1]

(d) Calculate the magnification of the image in Fig. 1.1.

Show your working and give your answer to the nearest whole number.

Answer = ...[2]

Oct/Nov 2010 (21)/Q5

Plant cell walls consist of cellulose that is embedded in a matrix of compounds, such as pectins and proteins.

Cell wall material is synthesised inside the cell and transported to the cell surface membrane as shown in the drawing made from an electron micrograph in Fig. 5.2.

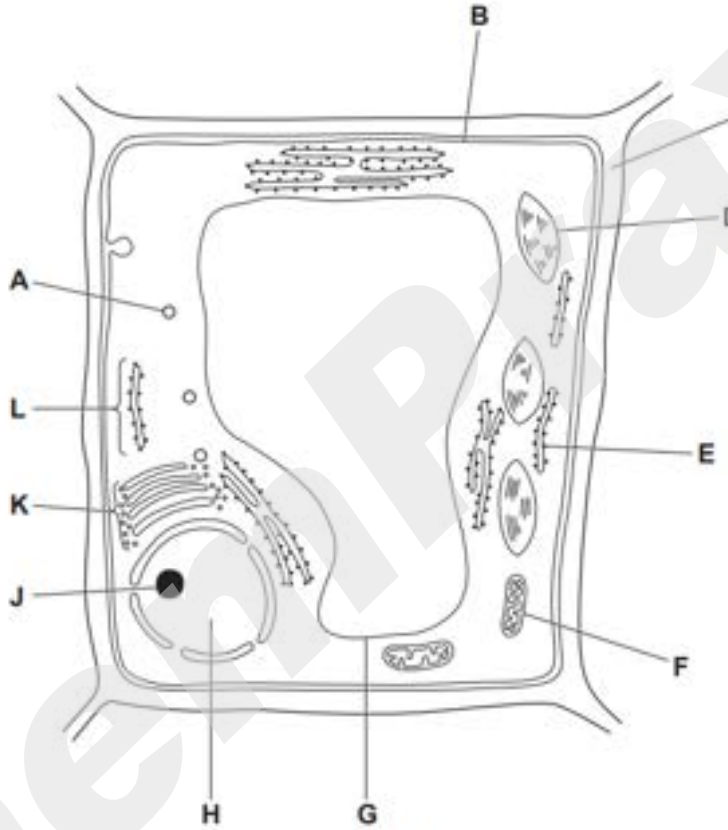

Fig. 5.2

(c) Locate the parts of the cell labelled in Fig. 5.2 which apply to each of the following statements. You must only give one letter in each case. You may use each letter once, more than once or not at all. The first answer has been completed for you.

statement	letter from Fig. 5.2
organelle that contains DNA	H
transports cell wall material to the cell surface membrane	
site of transcription	
site of ribosome synthesis	
site of photosynthesis	

[4]

Oct/Nov 2010 (22)

6 Fig. 6.1 is a section through lung tissue showing an alveolus and its blood supply.

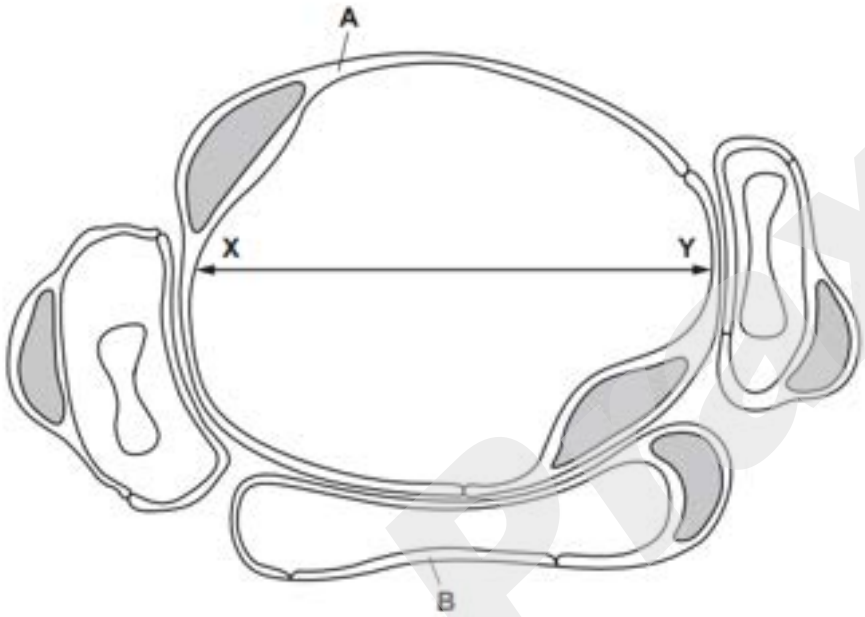

Fig. **6.1**

(b) The actual diameter of the alveolus along the line **X–Y** is 220 micrometres (μm). Calculate the magnification of Fig. 6.1.

Show your working and give your answer to the nearest whole number.

answer × ..... [2]

May/June 2011 (21)

1 Fig. 1.1 is an electron micrograph of cells from the ciliated epithelium of the trachea.

Fig. 1.1

(a) Calculate the magnification of the electron micrograph in Fig. 1.1.

Show your working and express your answer to the nearest whole number.

magnification × .....[2]

May/June 2011 (22)/Q4

Fig. 4.1 is a transmission electron micrograph of the organism that causes tuberculosis.

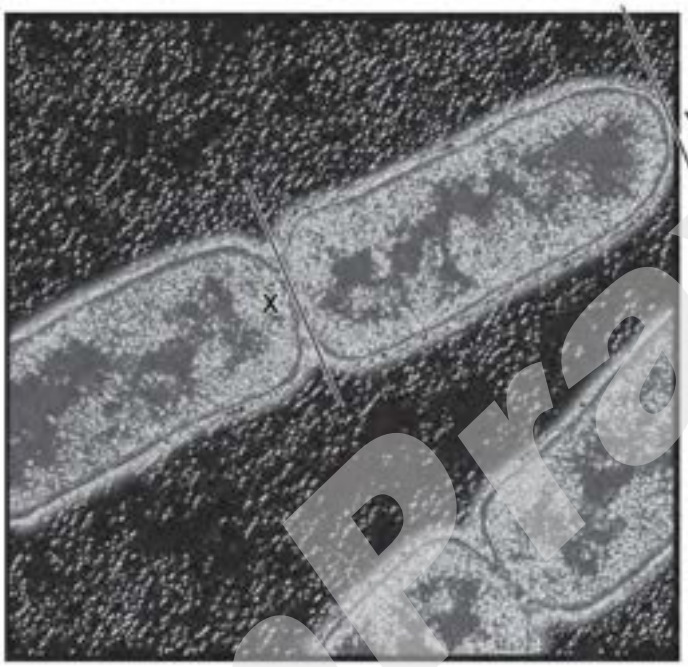

Fig. **4.1**

(b) (i) The actual length of the cell between **X** and **Y** in Fig. 3.1 is 2 µm.

Calculate the magnification of the electron micrograph.

Show your working and give your answer to the nearest whole number.

magnification × ..... [2]

(ii) The organism that causes tuberculosis is a prokaryote. State three features of prokaryotes.

1. .....

2. .....

3. ..... [3]

Oct/Nov 2011 (21)

5 Phloem transfer cells are modified companion cells that move sucrose and other assimilates from mesophyll tissue into phloem sieve tube elements.

Fig. 5.1 is an electron micrograph of a phloem transfer cell.

magnification = × 10 000

Fig. 5.1

(a) Calculate the actual distance across the transfer cell from **X** to **Y**.

Show your working and express your answer to the nearest micrometre.

answer ..... μm [2]

Oct/Nov 2011 (22)

6 Fig. 6.1 shows a phloem sieve tube element, its companion cell and a mesophyll cell in the leaf of a photosynthesising plant.

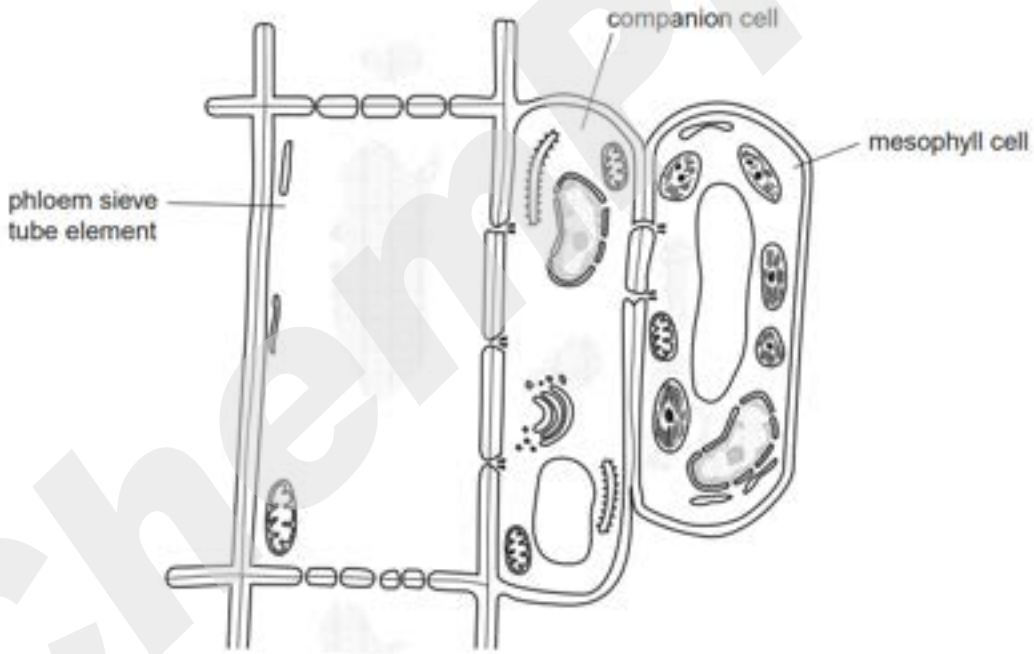

Fig. 6.1

(a) Use label lines and the letters **C** to **E** to identify the following on Fig. 6.1.

C – a structure involved in ribosome synthesis

D – an organelle that is involved in the modification and packaging of proteins

E – an organelle that is involved in aerobic respiration [3]

Oct/Nov 2011 (23)

1 Fig. 1.1 is an electron micrograph of three cells of the same species of bacterium, *Erwinia carotovora*.

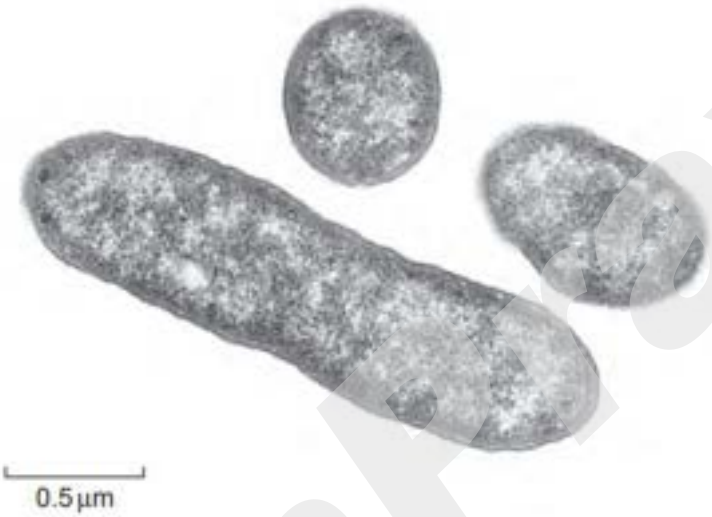

Fig. 1.1

(a) Calculate the magnification of the electron micrograph in Fig. 1.1.

Show your working and give your answer to the nearest 10000.

magnification × ..... [2]

(b) Name three structures, present in animal cells, which are **not** present in the cells shown in Fig. 1.1.

1. .....

.....

2. .....

.....

3. .....

..... [3]

(c) *E. carotovora* is a rod-shaped bacterium.

Explain why two of the bacterial cells in Fig. 1.1 do not appear rod-shaped.

.....

.....

.....

..... [1]

May/June 2012 (21)

2 Fig. 2.1 shows a drawing made from an electron micrograph of two adjacent cells in a leaf.

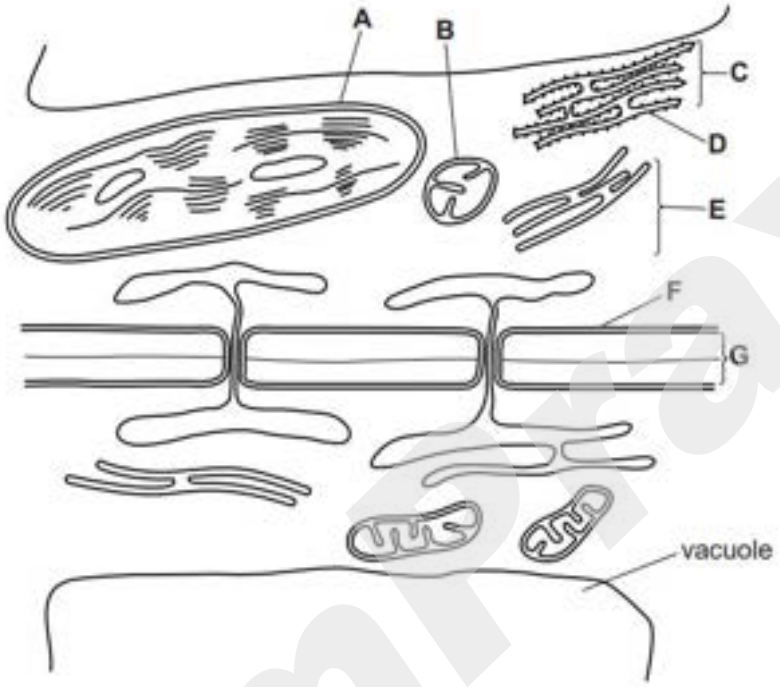

Fig. 2.1

(a) Structures **A** and **B** are both visible using the light microscope, but the internal detail of these organelles shown in Fig. 2.1 is only visible using the electron microscope.

Explain why the internal details of structures **A** and **B** are only visible when using the electron microscope and not when using the light microscope.

.....

.....

.....

.....

.....

.....[3]

(b) Name in full the structures labelled **C**, **D** and **E**.

C .....

D .....

E ..... [3]

(c) State **one** role of vacuoles in plant cells.

..... [1]

May/June 2012 (22)

2 Fig. 2.1 is a transmission electron micrograph of a plasma cell. Plasma cells are antibody-secreting cells that are formed from B-lymphocytes.

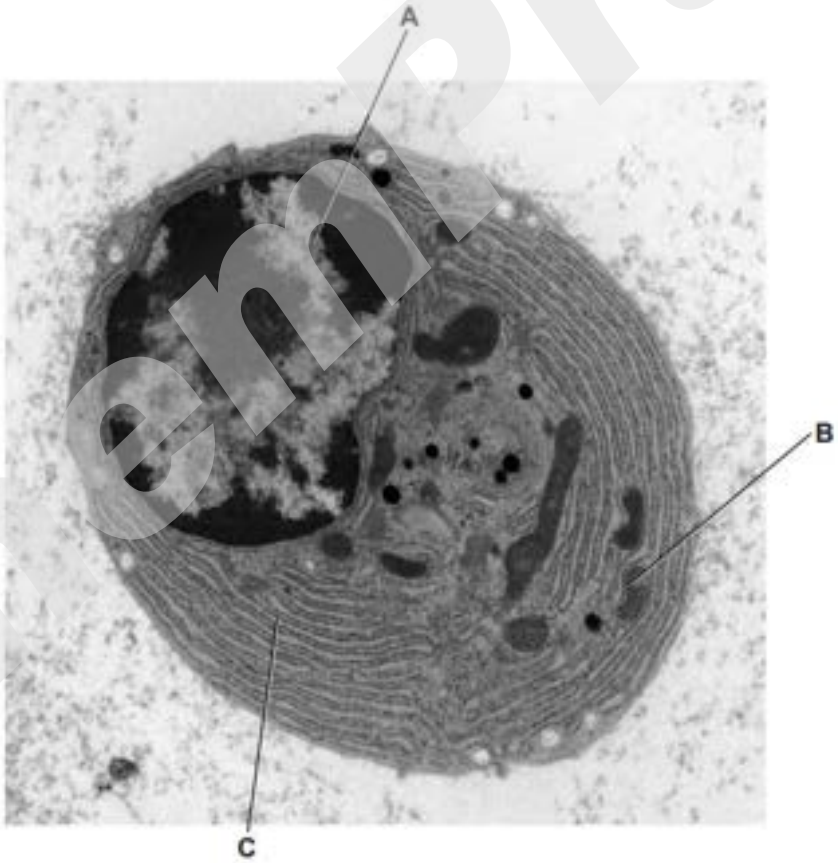

Fig. 2.1

(a) Complete Table 2.1 to:

- name in full, structures **A**, **B** and **C**
- outline how each structure functions to contribute to the **specific role of the plasma cell**.

Table 2.1

structure	name of structure	function of structure within plasma cell
A		
B		
C		

[6]

May/June 2012 (23)

1 Fig. 1.1 is an electron micrograph of a cross section through a blood vessel.

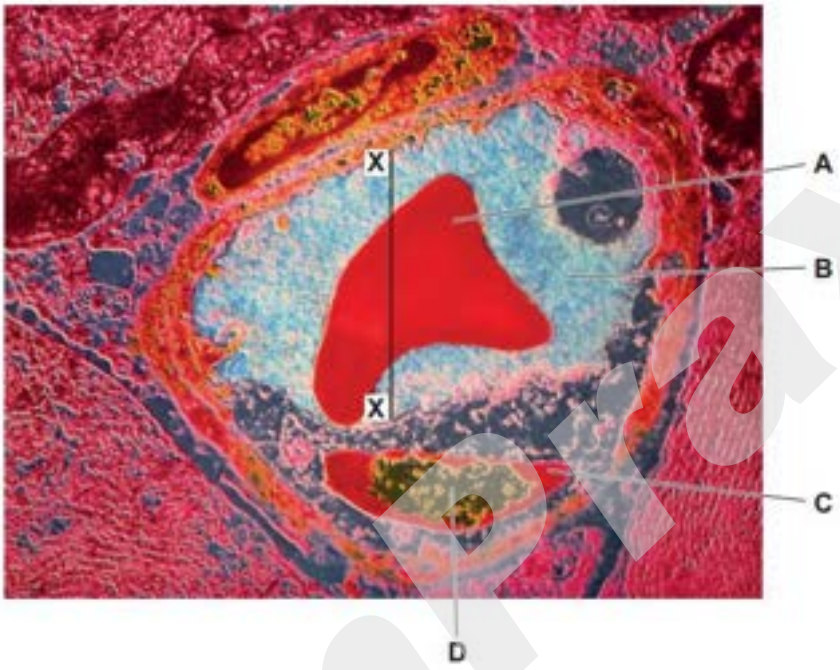

Fig. 1.1

(iii) Cell **C** in Fig. 1.1 is an endothelial cell.

Name structure D.

.....[1]

(c) The magnification of Fig. 1.1 is × 6000.

Calculate the diameter of the lumen along the line **X–X**.

Show your working and give your answer in micrometres (μm) to the nearest whole number.

answer ..... μm [2]

Oct/Nov 2012 (21)

1 Fig. 1.1 is a drawing made from an electron micrograph of a mammalian liver cell.

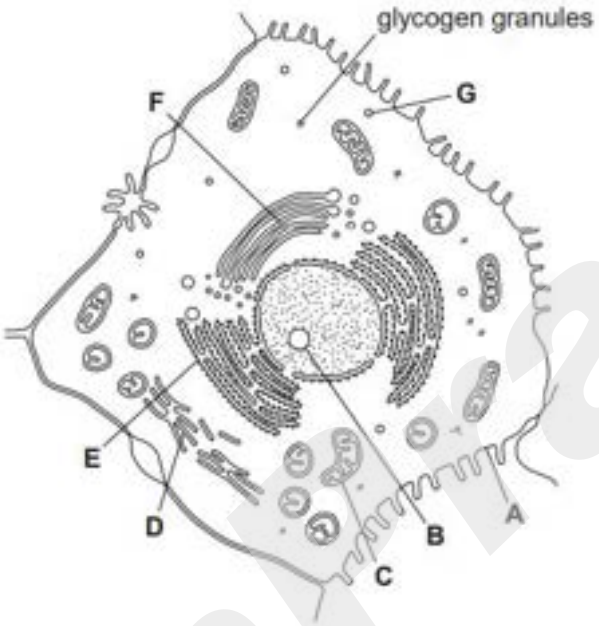

Fig. 1.1

(a) Complete the table by naming the structures **B** to **G** and stating **one** function of each. The first one (**A**) has been completed for you.

	name of organelle	function
A	cell surface membrane	controls movement of substances into and out of the cell
B		
C		
D		
E		
F		
G		

[6]

Oct/Nov 2012 (22)

1 Fig. 1.1 is a labelled diagram of a leaf palisade mesophyll cell, as seen with a high quality light microscope.

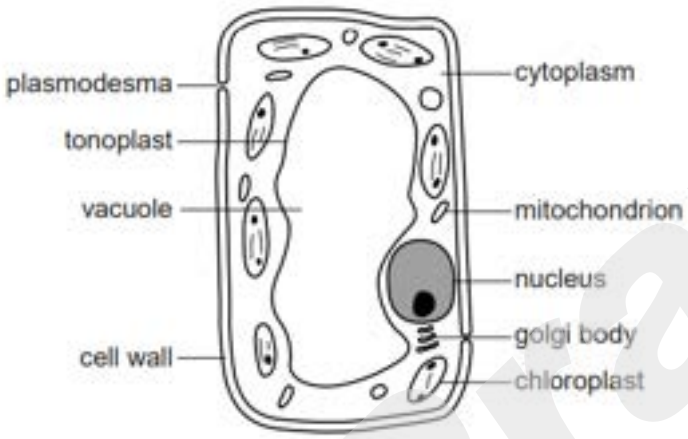

Fig. 1.1

An electron micrograph of the same leaf mesophyll cell at the **same magnification** would show more detail than is shown in Fig. 1.1.

(a) Explain why, at the **same** magnification, an electron micrograph is able to provide more detail than a light micrograph.

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..... [2]

(b) **Describe** three additional features that could be seen on an electron micrograph of the leaf mesophyll cell that are not seen in Fig. 1.1.

1. .....

.....

2. .....

.....

3. .....

..... [3]

(c) The length of the labelled chloroplast in Fig. 1.1 is 5.0 μm. Calculate the magnification of the cell shown in Fig. 1.1.

Show your working.

magnification × ..... [2]

Oct/Nov 2012 (23)

1 Fig. 1.1 shows electron micrographs of some eukaryotic cell organelles.

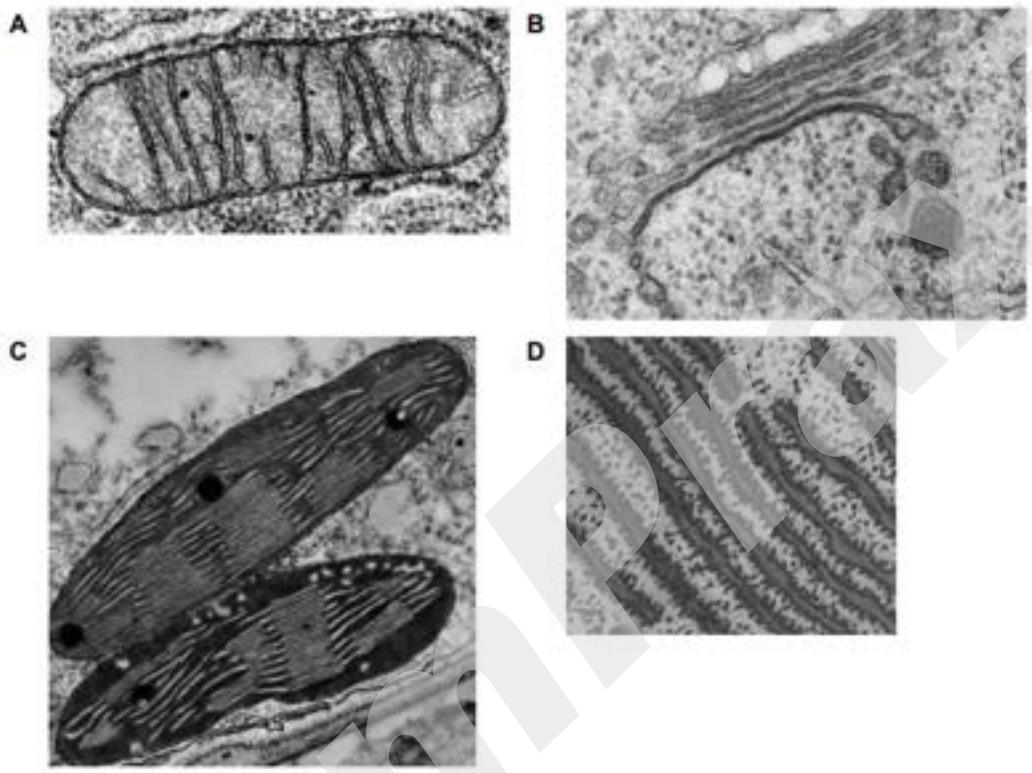


Fig. 1.1

For each of the organelles **A**, **B**, **C** and **D**, shown in Fig. 1.1, state the name and function of each.

A *name* .....

function.....

B *name* .....

function.....

C *name* .....

function.....

D *name* .....

function.....[8]

4 Fig. 4.1 is an electron micrograph of a transverse section through a plant stem. The xylem vessels are clearly visible.

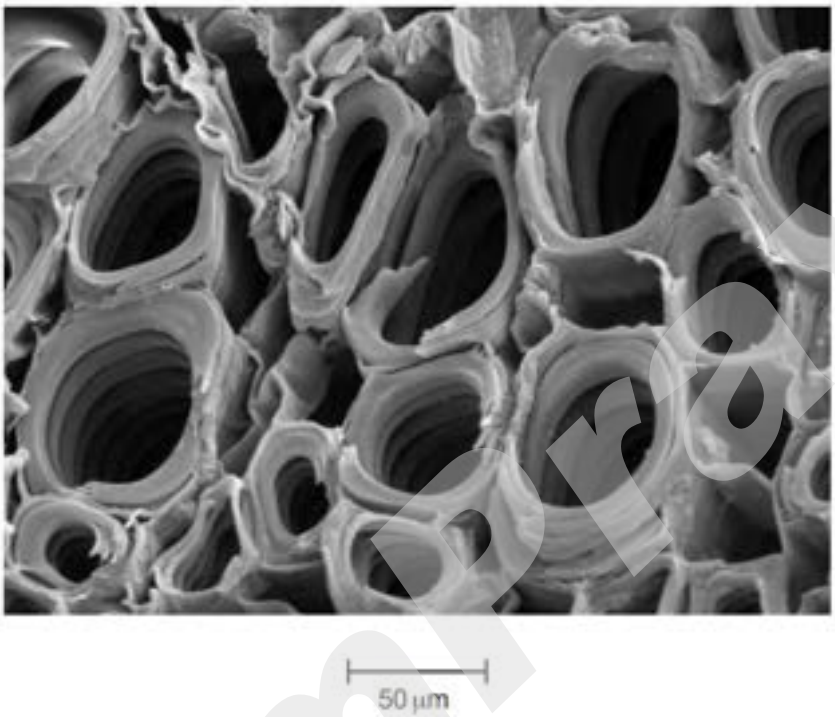


Fig. 4.1

(a) Calculate the magnification of the electron micrograph in Fig. 4.1.

Show your working and give your answer to the nearest 100.

answer .....[2]

May/June 2013 (21)

1 Capillaries are known as exchange vessels. Substances are exchanged between blood and tissue fluid as the blood flows through the capillaries.

Fig. 1.1 is an electron micrograph of a section through a capillary with two red blood cells.

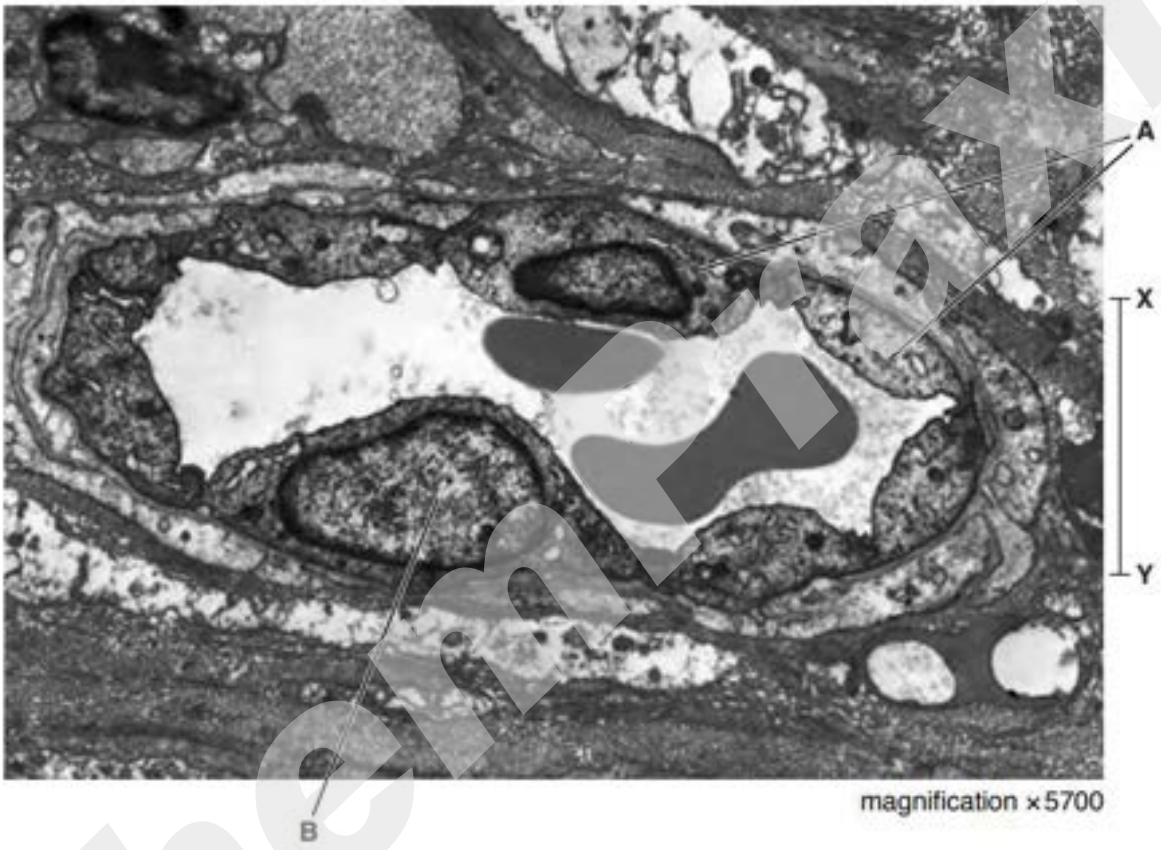


Fig. 1.1

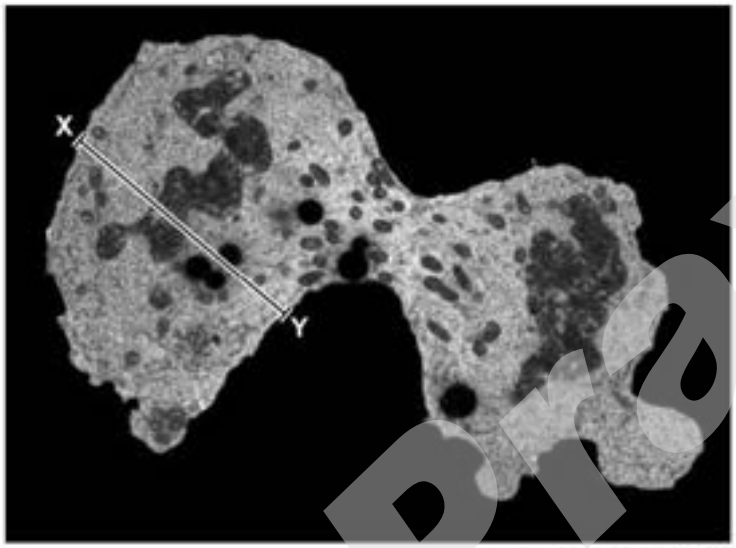
(ii) Calculate the actual distance **X – Y** on Fig. 1.1.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

May/June 2013 (22)/Q1

(b) Fig. 1.2 is a transmission electron micrograph of a dividing cancer cell.



magnification x 3000

Fig. 1.2

(i) Calculate the actual width of the cell shown in Fig. 1.2 at **X-Y**.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

(ii) The cancer cell shown in Fig. 1.2 has more mitochondria and rough endoplasmic reticula (RER) compared to the non-cancerous cell from which it originated.

Suggest why this is so.

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.....

.....

..... [2]

2 Fig. 2.1 shows xylem tissue in a longitudinal section through the stem of a dicotyledonous plant.

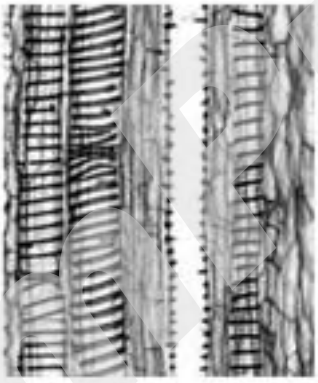

Fig. 2.1

(b) It is possible to obtain images, such as Fig. 2.1, at the same magnification with both the light microscope and the electron microscope.

State the advantages of using the light microscope, rather than using the electron microscope, in studies of tissues.

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.....

.....

.....

..... [2]

May/June 2013 (22)

1 Fig. 1.1 is an electron micrograph of a transverse section of palisade mesophyll tissue in the leaf of the flowering plant, *Zinnia elegans*.

Fig. 1.1

(a) Name the features labelled **A**, **B** and **C**.

A .....

B .....

C .....

[3]

(b) Calculate the width of the vacuole across the line **X**-**Y**.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

Oct/Nov 2013 (21)

4 Cholesterol is synthesised in the smooth endoplasmic reticulum (SER) in liver cells by a series of enzyme-catalysed reactions.

Within the SER, molecules of cholesterol and triglycerides are surrounded by proteins and phospholipids to form lipoproteins. These lipoprotein particles enter the Golgi apparatus where they are packaged into vesicles and pass to the blood.

Fig. 4.1 is an electron micrograph of part of a liver cell showing lipoprotein particles within the Golgi apparatus.

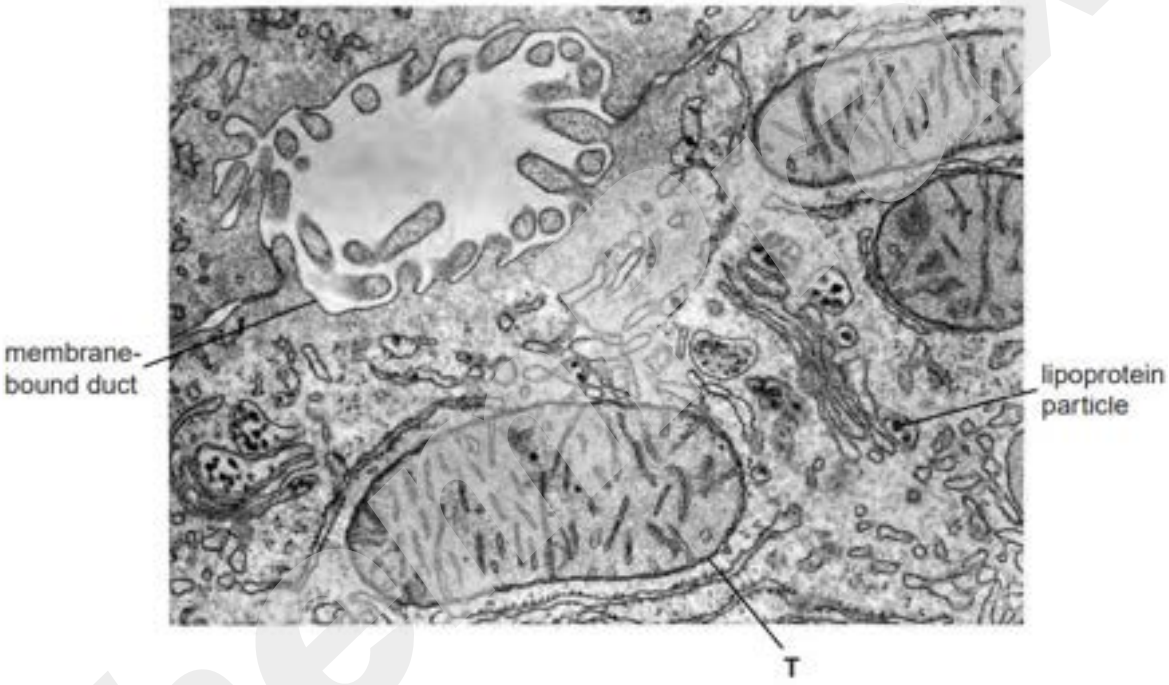


Fig. 4.1

(a) Name structure **T** in Fig. 4.1 and state its role in liver cells.

.....

.....

.....

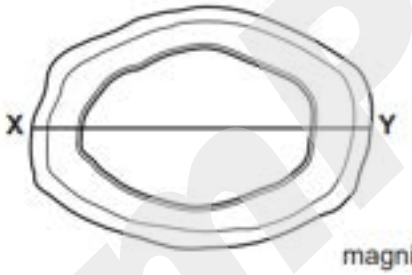
.....

.....

.....[3]

Oct/Nov 2013 (22)

1 Fig. 1.1 is a diagram of a transverse section through a vein.



magnification × 35

Fig. 1.1

(a) Calculate the actual diameter of the vein marked by the line **X–Y**.

Show your working and give your answer in millimetres (mm).

answer ..... mm [2]

4 *Staphylococcus aureus* is a bacterium that is the cause of many different infectious diseases.

(a) Fig. 4.1 is a diagram of *S. aureus*.

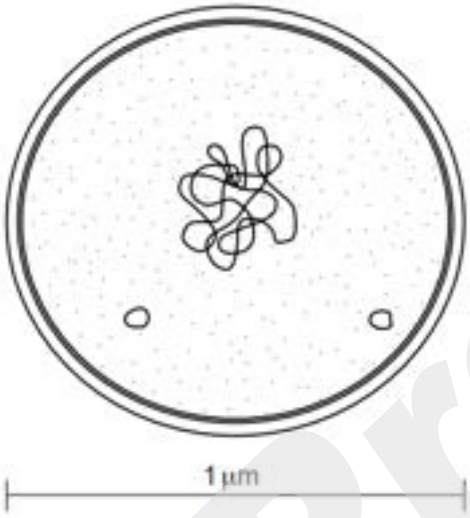


Fig. 4.1

(i) Cell structures, such as mitochondria, endoplasmic reticula (ER), Golgi apparatus, lysosomes and chloroplasts are found only in eukaryotic cells. These are not present in Fig. 4.1.

With reference to Fig. 4.1, describe **other features** that support the fact that *S. aureus* is a prokaryote.

.....

.....

.....

.....

.....

.....[3]

(ii) State the main difference in the composition of the plant cell wall compared to the bacterial cell wall.

plant cell wall .....

bacterial cell wall .....[2]

Oct/Nov 2013 (23)

3 Fig. 3.1 is a photomicrograph of two animal cells, **A** and **B**, at different stages of the mitotic cell cycle.

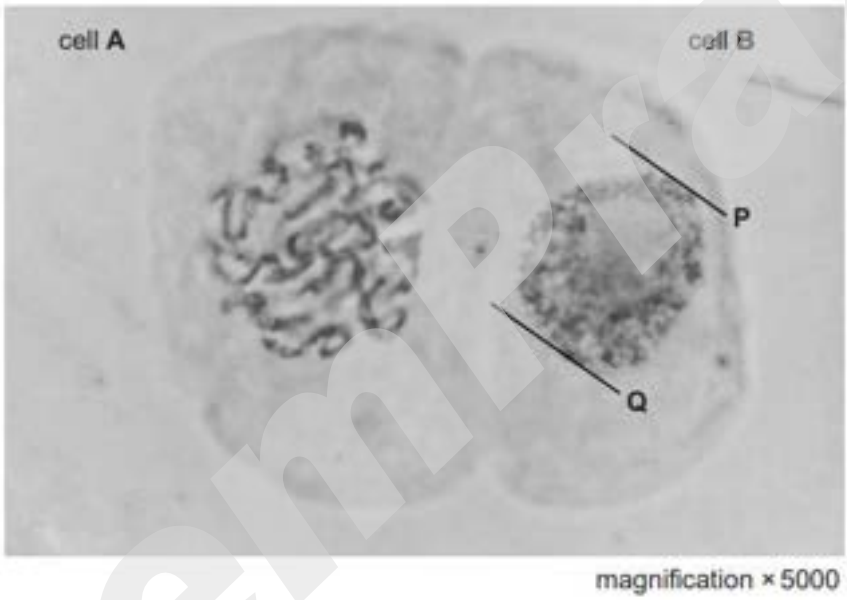


Fig. 3.1

(b) The magnification of Fig. 3.1 is ×5000.

Calculate the diameter of the nucleus of cell **B** between lines **P** and **Q**.

Show your working and give your answer to the nearest micrometre (μm).

answer ..... μm [2]

(c) State the advantages of light microscopy, rather than electron microscopy, for studies of the cell cycle.

.....

.....

.....

.....

.....

.....

.....

..... [3]

May/June 2014 (21)

1 *Vibrio cholerae* is a prokaryotic organism.

Fig. 1.1 shows the structure of a cell of *V. cholerae*.

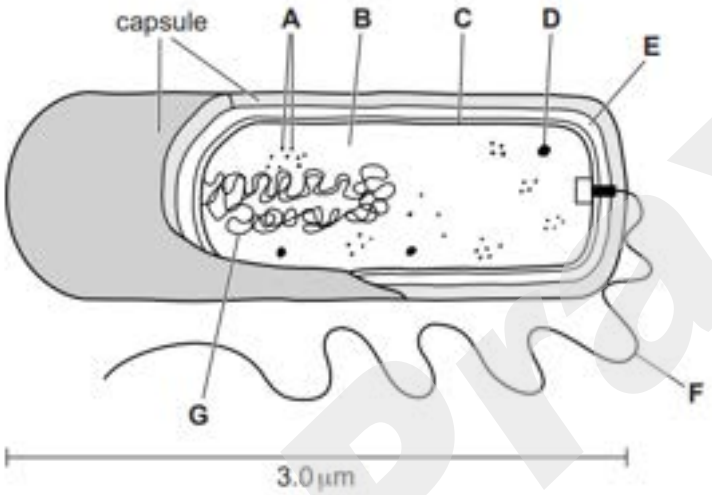


Fig. 1.1

(a) Calculate the magnification of Fig. 1.1.
Show your working and give your answer to the nearest whole number.

magnification × ..... [2]

(b) Locate the structures in Fig. 1.1 that apply to each of the features shown in Table 1.1.
Complete Table 1.1 by writing the appropriate letter and the name of the structure.
You must only give one letter in each case. You may use each letter once, more than once or not at all. The first answer has been completed for you.

Table 1.1

feature	identity	name
provides motility	**F**	flagellum
stores genetic information		
partially permeable		
composed of murein (peptidoglycan)		
site of translation		

[4]

(c) State three **structural** features that are present in a mesophyll cell in a leaf that are **not** present in a prokaryotic cell such as that of *V. cholerae*.

1. .....

2. .....

3. .....

[3]

May/June 2014 (22)

2 Fig. 2.1 is a transmission electron micrograph of cells from a spinach leaf.

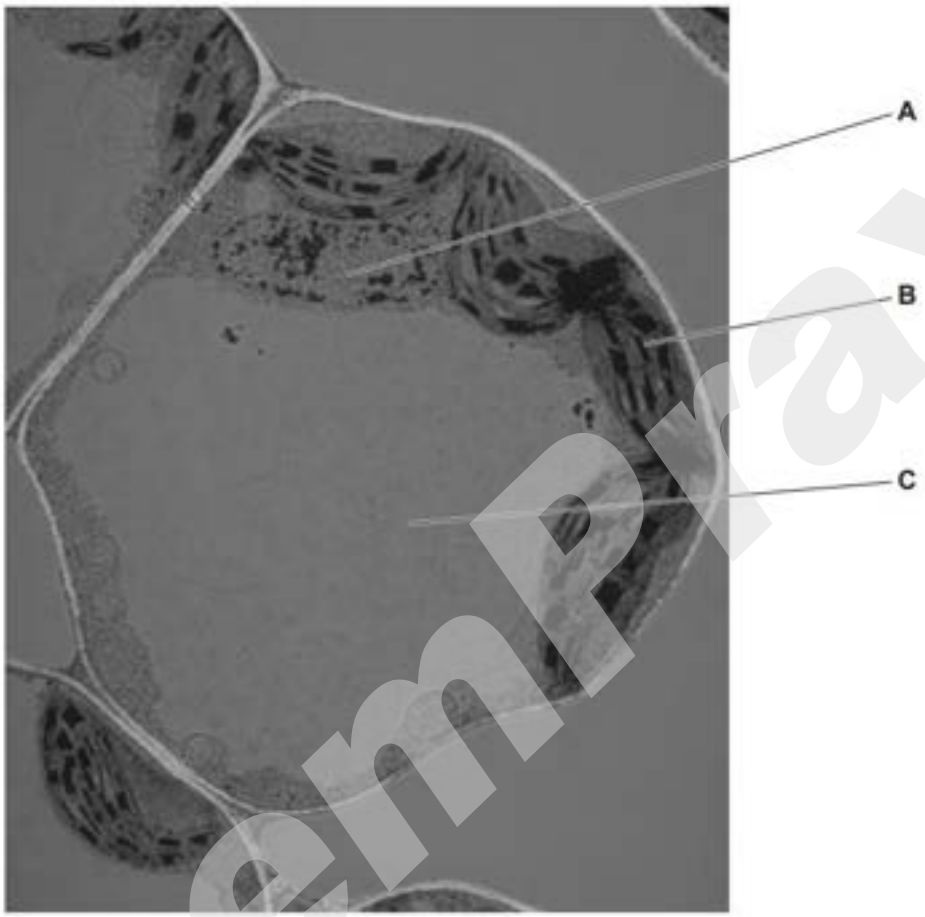


Fig. 2.1

(a) Name the organelles **A**, **B** and **C**.

A .....

B .....

C .....

[3]

(b) List two cell structures that could be present in animal cells that are not present in plant leaf cells.

1. .....

2. .....

[1]

May/June 2014 (23)

4 Fig. 4.1 is a light micrograph of a section through a leaf of the xerophytic plant *Nerium oleander*. An area containing one of the plant's stomata is circled.

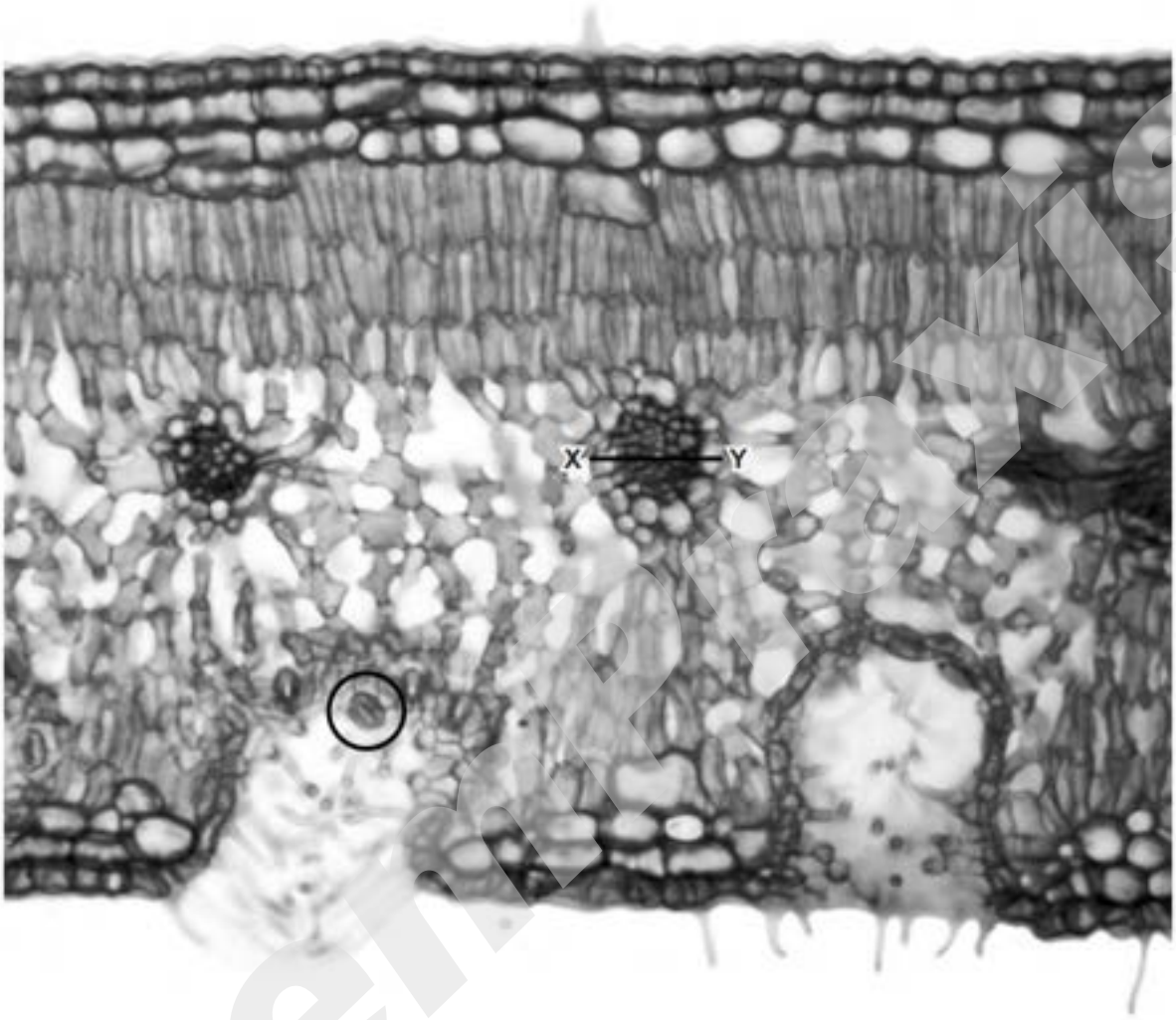


Fig. 4.1

(b) Calculate the diameter of the vascular bundle across the line **X-Y**.

Show your working and give your answer to the nearest 100 μm.

answer ..... μm [2]

Oct/Nov 2014 (21)

1 Fig. 1.1 is an electron micrograph of cells from the lining of the small intestine.

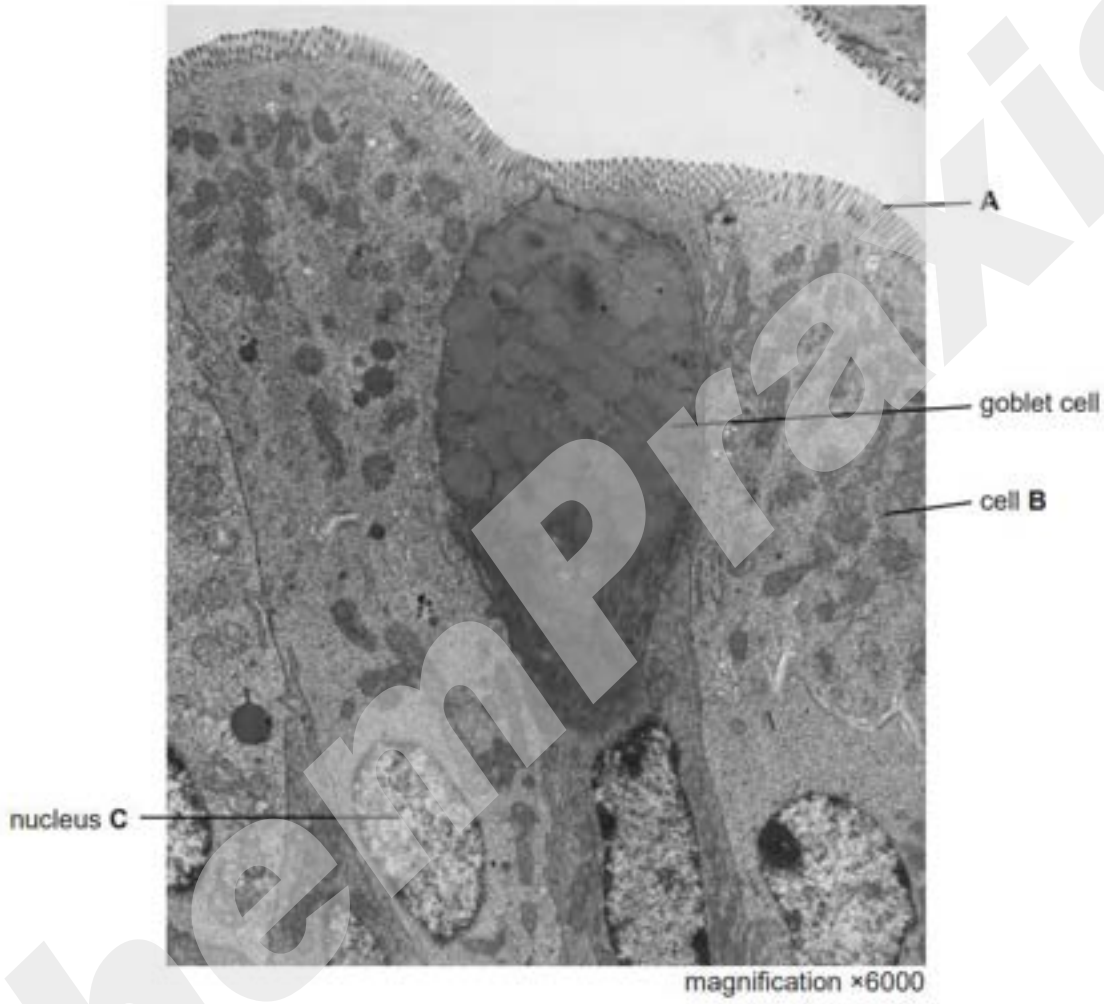


Fig. 1.1

(a) Identify the structures labelled **A** and state their role for the cell.

.....

.....

.....

.....

..... [2]

(b) There are many mitochondria in cell **B**.

Suggest why cell **B** contains a large number of mitochondria.

.....

.....

.....

.....

..... [2]

(c) Calculate the actual length of the nucleus **C**.

Show your working and express your answer to the nearest 0.1 micrometre.

answer ..... μm [2]

Oct/Nov 2014 (22)

(c) Fig. 6.1 shows *A. tumefaciens* on the surface of cells of a tobacco plant, *Nicotiana plumbaginifolia*.

The cells **X** and **Y** are newly formed cells.

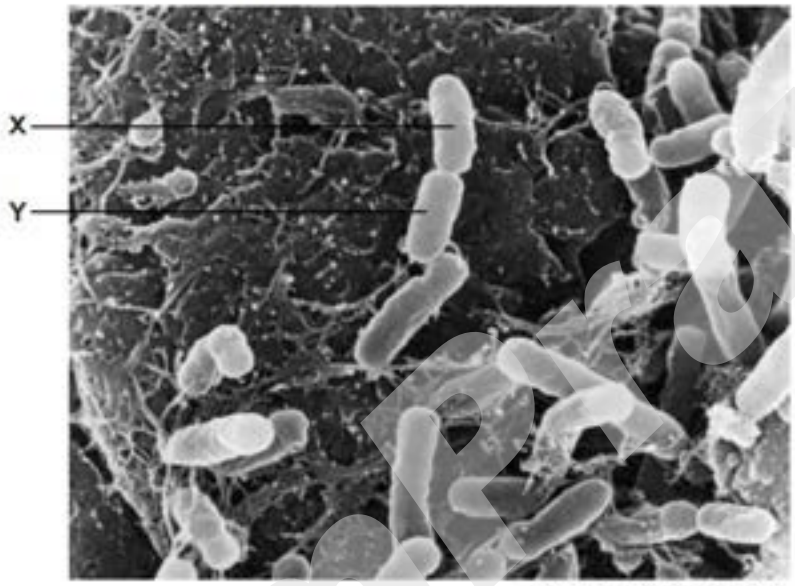


Fig. 6.1

Calculate the actual length of cell **X** in micrometres.

Show your working.

answer ..... μm [2]

Oct/Nov 2014 (23)

1 Fig. 1.1 is a photomicrograph of plant root cells near the growing tip. Some of the cells are undergoing mitosis.

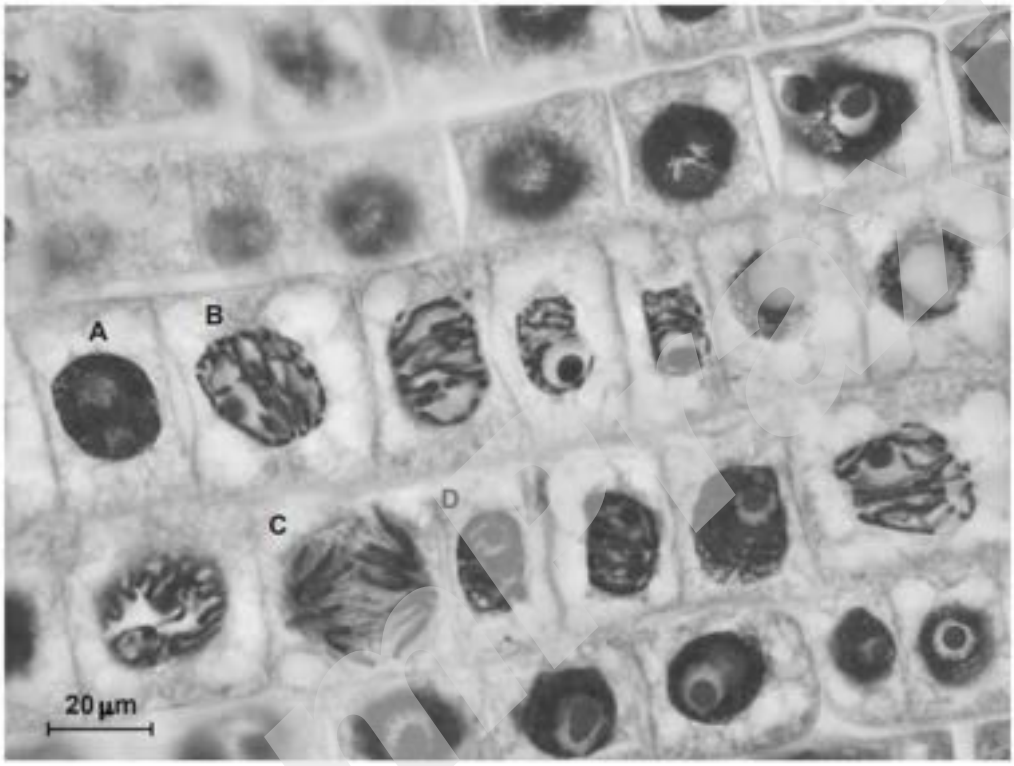


Fig. 1.1

(a) State **one** feature, visible in Fig. 1.1, which indicates that the section is taken from plant tissue and not animal tissue.

.....

.....[1]

(e) Calculate the magnification of Fig. 1.1.

Show your working and give your answer to the nearest whole number.

magnification × ..... [2]

May/June 2015 (22)/Q3

Fig. 3.2 shows red blood cells within a capillary. The capillary shown in Fig. 3.2 allows the rapid exchange of substances between the blood, tissue fluid and body cells.

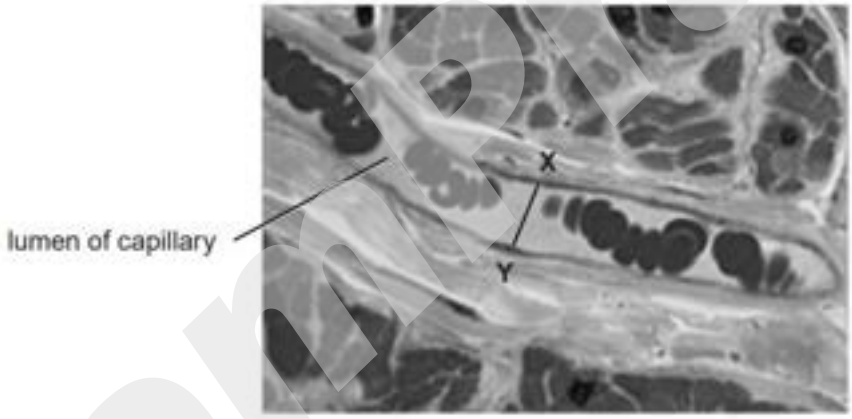


Fig. 3.2

(c) The actual diameter of the lumen of the capillary at the point **X–Y** in Fig. 3.2 is 9.5 μm.

Calculate the magnification of the image shown in Fig. 3.2. Show your working.

magnification × ..... [2]

May/June 2015 (23)

3 Fig. 3.1 is an electron micrograph of a type of B-lymphocyte called a plasma cell.

Plasma cells secrete antibody molecules.

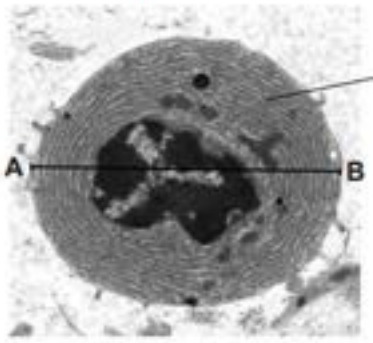


Fig. 3.1

(a) Suggest why plasma cells contain a large quantity of rough endoplasmic reticulum.

.....

.....

.....

.....

.....[2]

(b) The diameter A – B of the plasma cell in Fig. 3.1 is 15 μm.

Calculate the magnification of Fig. 3.1.

Show your working.

magnification × ..... [2]

5 Fig. 5.1 is a light micrograph of some unicellular photosynthetic organisms called *Chlamydomonas*.

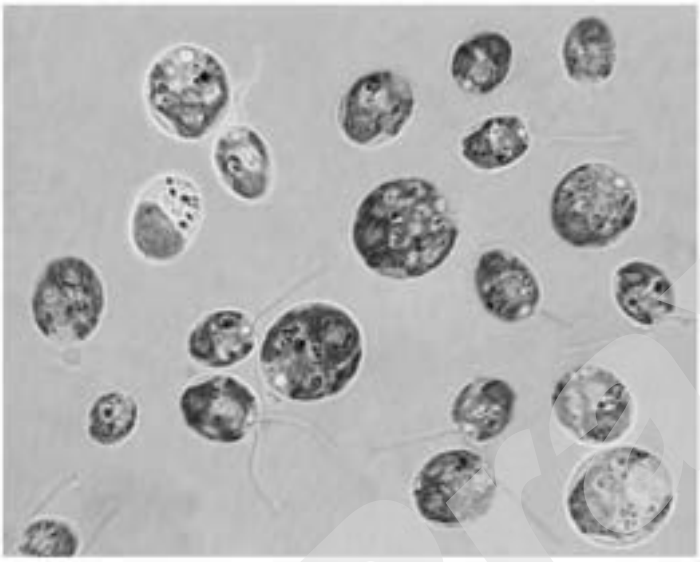


Fig. **5**.1

(a) *Chlamydomonas* moves through water.

Explain why the light microscope rather than the electron microscope is used to observe the movement of *Chlamydomonas*.

.....

.....

.....

.....

.....[2]

Oct/Nov 2015 (21)

1 Fig. 1.1 is an electron micrograph of a mitochondrion.

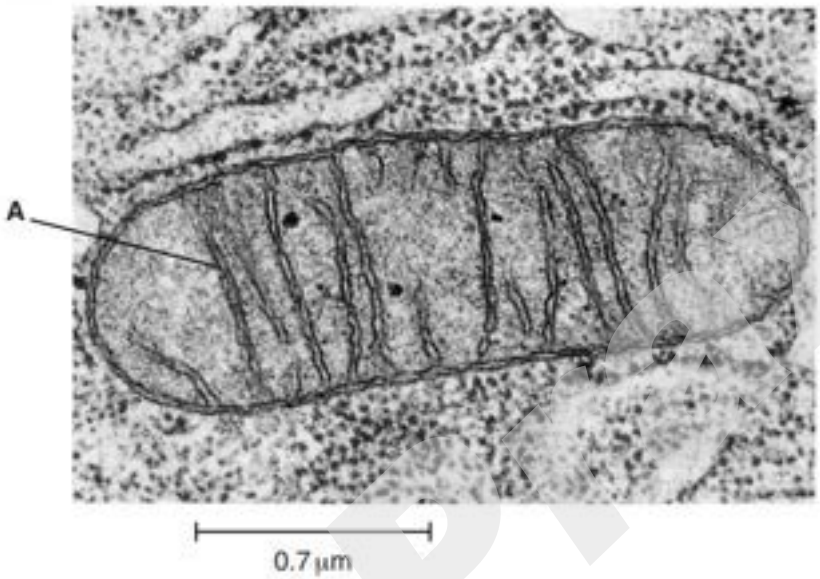


Fig. 1.1

(a) State the function of mitochondria.

..... [1]

(b) Name structure A.

..... [1]

(c) Calculate the magnification of the image in Fig. 1.1.

Show your working.

magnification × ..... [2]

(d) Explain why the light microscope could **not** be used to produce the image in Fig. 1.1.

.....

.....

.....

.....

..... [2]

(e) Scientists think that mitochondria were once prokaryotes. The evidence for this is that mitochondria have features in common with prokaryotes.

State two features that mitochondria have in common with prokaryotes.

1. .....

2. .....

[2]

Oct/Nov 2015 (22)

1 A student compared an image of a plant cell with an image of an animal cell. Both images were at the same magnification.

Parts **(a)** to **(c)** are four correct comparative statements about these images.

(a) Both cells contain large numbers of an organelle, bound by a double membrane. The inner membrane of these organelles is folded. These organelles all have a similar structure but do not always appear to have the same shape.

(i) State the name of the organelles described.

..... [1]

(ii) Suggest **one** reason why the organelles described do not always seem to have the same shape.

.....

.....

..... [1]

(b) Both cells contain cell structures that are approximately 25 nm in diameter and are **not** bound by a membrane.

(i) State the name of the cell structures described.

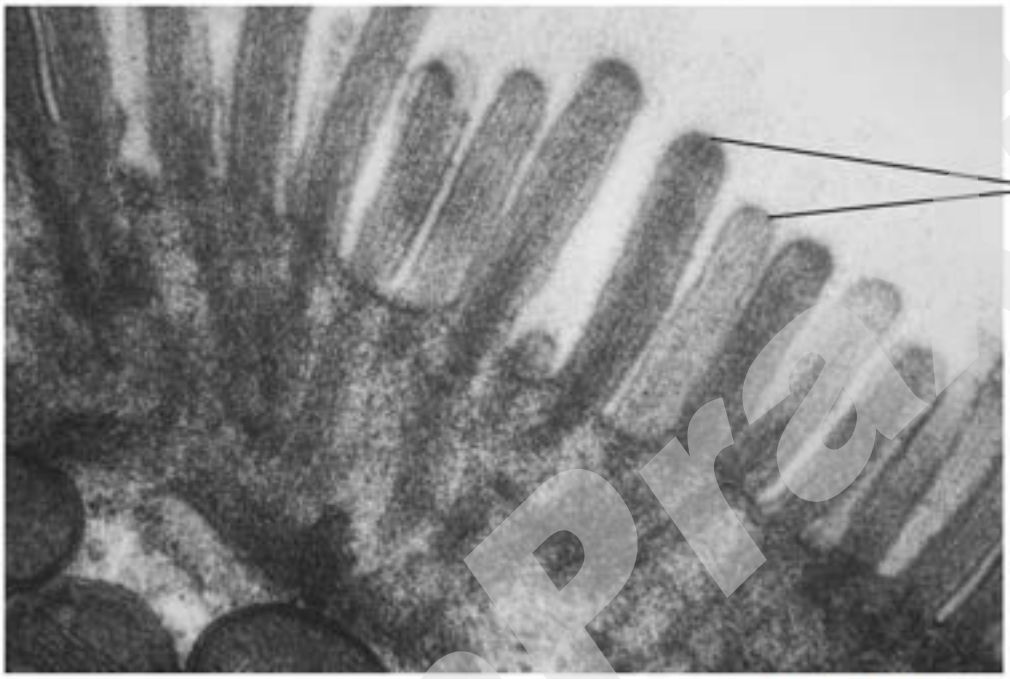
..... [1]

(ii) Draw a circle around the measurement that has the same value as 25 nm.

0.00025 μm **0.0025 μm** **0.025 μm** **0. 25 μm** **2.5 μm**

[1]

(d) Fig. 1.1 is a transmission electron micrograph of part of an epithelial cell from the small intestine of a mammal.



magnification × 65000

Fig. 1.1

Name the cell structures labelled **X** in Fig. 1.1 **and** state their function.

.....

.....

.....

..... [1]