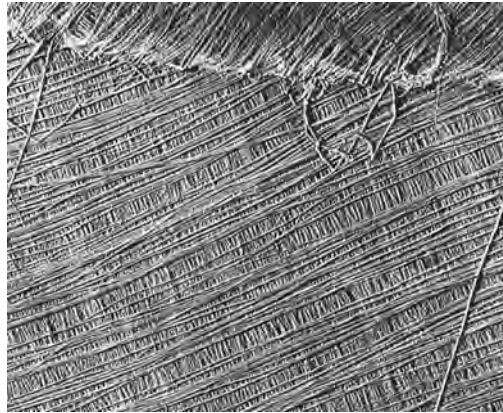


1 The photograph below shows part of a cellulose cell wall, as seen using an electron microscope.



© Biophoto Associates/Science Photo Library

Magnification $\times 70\,000$

(a) Using the information in the photograph and your own knowledge, describe the structure of a cellulose cell wall.

(3)

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(b) Cellulose can be used to produce biofuel. The xylem tissue in wood is a good source of cellulose. The cell walls of this tissue are heavily lignified.

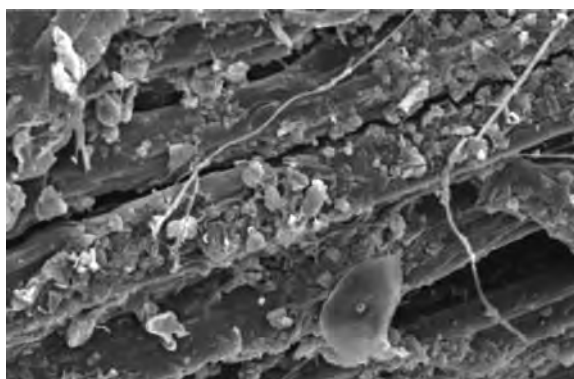
(i) Explain what is meant by the term **tissue**.

(2)

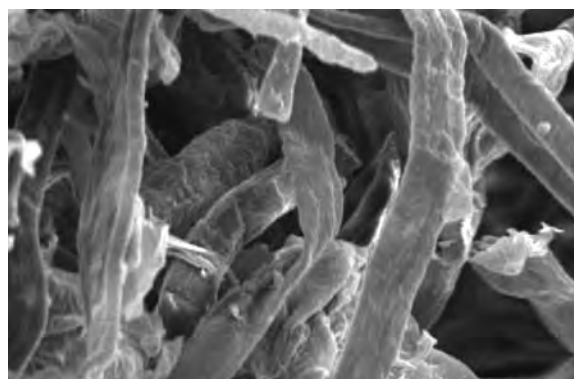
(ii) The cellulose in the xylem tissue of wood has to be broken down by enzymes before it can be used to produce biofuels.

The lignin has to be removed before the enzymes can be used to break down the cellulose.

The photographs below show fibres containing cellulose before and after the removal of lignin.



Before removal of lignin



After removal of lignin

Source: SciELO

Magnification $\times 500$

Using the information from the photographs, suggest how lignin adds strength to xylem tissue.

(2)

(c) Mineral ions such as calcium, nitrate and magnesium are transported in the xylem vessels. These mineral ions are dissolved in water.

(i) Describe how the structure of xylem vessels allows them to transport water.

(2)

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(ii) Explain how calcium, nitrate and magnesium ions are used by plants.

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(Total for Question 1 = 12 marks)

2 Prokaryotic and eukaryotic organisms can be classified depending on their cellular structure.

(a) Describe **three** structural differences between prokaryotic and eukaryotic cells.

(3)

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(b) In 1977, Carl Woese suggested that there are three domains of living organisms: the Archaea, the Bacteria and the Eukaryota.

He used molecular phylogeny to classify organisms into different domains.

Explain what is meant by the term **molecular phylogeny**.

(3)

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(c) The table below shows some of the cellular features of organisms belonging to the three different domains.

Feature	Archaea	Bacteria	Eukaryota
Cell membrane	Branched hydrocarbon chains attached to glycerol by ether bonds	Unbranched fatty acid chains attached to glycerol by ester bonds	Unbranched fatty acid chains attached to glycerol by ester bonds
Ribosome size	70S	70S	80S
Number of protein molecules in RNA polymerase	10	5	12
Peptidoglycan in cell wall	No	Yes	No
Type of chromosome	Circular	ircular	Linear

(i) Using information from this table, give evidence that supports Woese's conclusion that the Archaea are distinct from **both** the Bacteria and the Eukaryota.

(2)

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(ii) Using information from the table, explain why the Archaea are thought to be more closely related to Eukaryota than to Bacteria.

(2)

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(Total for Question 2 = 10 marks)

3 Organisms can be classified into three domains: Archaea, Bacteria and Eukaryota. Fungi belong to the domain Eukaryota.

(a) (i) State **two** differences between the structure of cells of organisms belonging to the Eukaryota domain and those belonging to the Bacteria domain.

(2)

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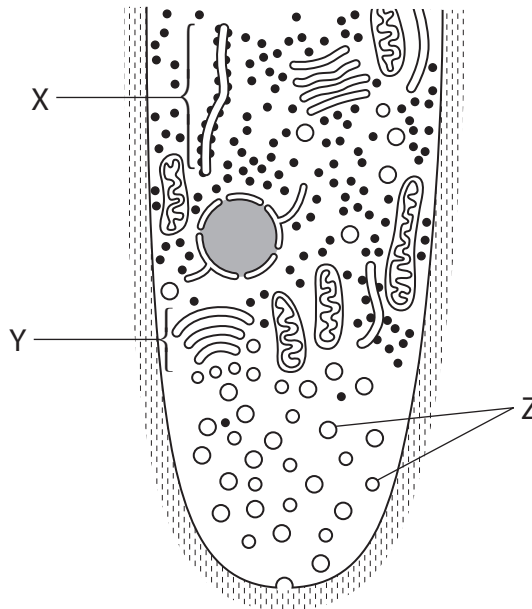
(ii) Name an organelle found in the cells of both eukaryotic and prokaryotic organisms.

(1)

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(b) Fungi have structures called hyphae that secrete enzymes used for the extracellular digestion of food.

The diagram below shows a growing tip of one fungal hypha containing vesicles, labelled Z. These vesicles contain digestive enzymes.



(i) Name the organelle labelled X on the diagram.

(1)

(ii) Place a cross (☒) in the box next to the correct name of the organelle labelled Y on the diagram.

(1)

- A** Golgi apparatus
- B** mitochondrion
- C** rough endoplasmic reticulum
- D** smooth endoplasmic reticulum

*(iii) The organelles labelled X, Y and Z on the diagram are involved in the synthesis and secretion of digestive enzymes.

Describe the roles of these organelles in the synthesis and secretion of digestive enzymes.

(4)

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(c) Fungi produce different enzymes that can digest starch or cellulose.

Using your knowledge of the structure of starch and cellulose, suggest why it is necessary for fungi to produce different enzymes to digest these two substances.

(4)

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(Total for Question 3 = 13 marks)

4 A student studied three different cells: an animal cell, a bacterial cell and a plant cell.

For each of the statements below, put a cross ☒ in the box that corresponds to the correct statement.

(a) DNA is located in the nucleus in

(1)

- A** the animal cell only
- B** the bacterial cell only
- C** two of the cells only
- D** all three cells

(b) A cell wall is present in

(1)

- A** the animal cell only
- B** the bacterial cell only
- C** the plant cell only
- D** two of the cells only

(c) Centrioles are present in

(1)

- A** the animal cell only
- B** the plant cell only
- C** two of the cells only
- D** all three cells

(d) A cell surface membrane is found in

(1)

- A** the bacterial cell only
- B** the plant cell only
- C** two of the cells only
- D** all three cells

(e) Mitochondria are found in (1)

- A** the bacterial cell only
- B** the plant cell only
- C** two of the cells only
- D** all three cells

(f) Ribosomes are found in (1)

- A** the animal cell only
- B** the bacterial cell only
- C** two of the cells only
- D** all three cells

(g) Smooth endoplasmic reticulum (SER) is present in (1)

- A** the animal cell only
- B** the bacterial cell only
- C** the plant cell only
- D** two of the cells only

(h) Amyloplasts may be present in (1)

- A** the animal cell only
- B** the bacterial cell only
- C** the plant cell only
- D** all three cells

(Total for Question 4 = 8 marks)