

Structured Questions: Paper 2

1.2 Cells: Origin & Ultrastructure

1.2.1 Origin of Cells / 1.2.2 Endosymbiotic Theory / 1.2.3 Prokaryotic Cell Structure / 1.2.4 Eukaryotic Cell Structure / 1.2.5 Exocrine Pancreatic & Palisade Mesophyll Cells / 1.2.6 Comparison of Prokaryotic & Eukaryotic Cells / 1.2.7 Microscopes / 1.2.8 Skills: Drawing Cells / 1.2.9 Skills: Cell Origin & Ultrastructure

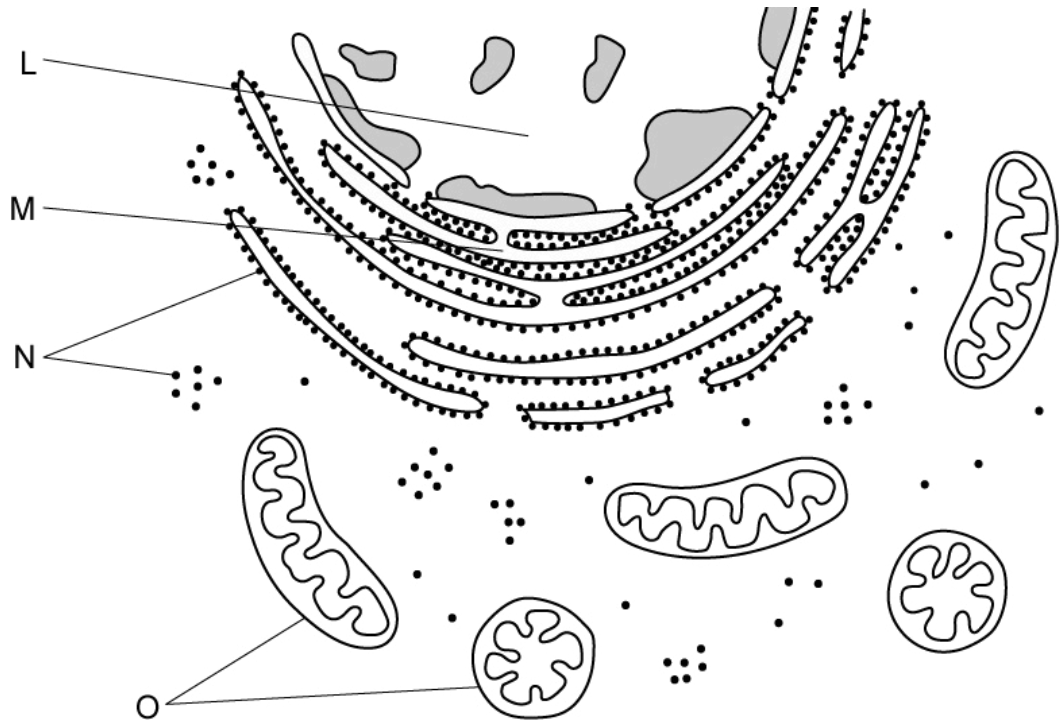
Easy (5 questions)	/39
Medium (5 questions)	/43
Hard (5 questions)	/49
Total Marks	/131

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Easy Questions

1 (a) The diagram below shows a magnified view of a cell.



List the names of the structures **L** and **N**.

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(2 marks)

(b) Another structure that would likely be present in the cell seen in part (a) is the golgi apparatus.

State the function of the golgi apparatus.

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(1 mark)

(c) State which type of cell (prokaryotic or eukaryotic) is featured in part (a).

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(1 mark)

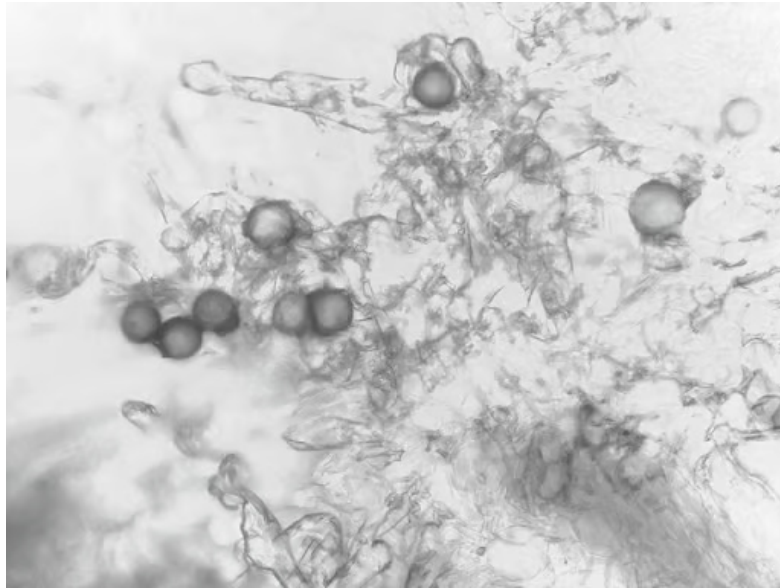
(d) Scientists have established a theory that explains the origin of eukaryotic cells.

State the name of this theory.

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(1 mark)

2 (a) The image below is of pollen grains taken under a light microscope.



[Source: By Ergriffi - Edit of File:Pollen grains on the surface of a stigma(Primula vulgaris).jpg, [https://commons.wikimedia.org/wiki/File:Pollen_grains_on_the_surface_of_a_stigma\(Primula_vulgaris\).jpg](https://commons.wikimedia.org/wiki/File:Pollen_grains_on_the_surface_of_a_stigma(Primula_vulgaris).jpg)]

State which type of microscope would enable scientists to examine the pollen grains in more detail.

..... (1 mark)

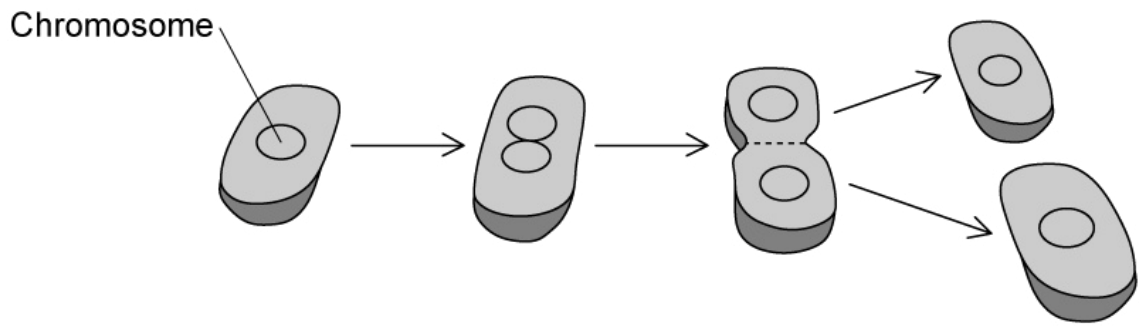
(b) List **two** advantages of the electron microscope.

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..... (2 marks)

(c) List three differences between prokaryotic and eukaryotic cells.

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..... (3 marks)

(d) State the name of the type of asexual reproduction that the prokaryotic cell in the diagram below is undergoing.



(1 mark)

3 (a) The first cells on Earth are thought to have arisen from non-living materials.

List **four** processes that scientists believe were required for the first cells to be formed.

(4 marks)

(b) The improvements in scientific apparatus has led to developments in scientific research, including having a better understanding of the ultrastructure of cells.

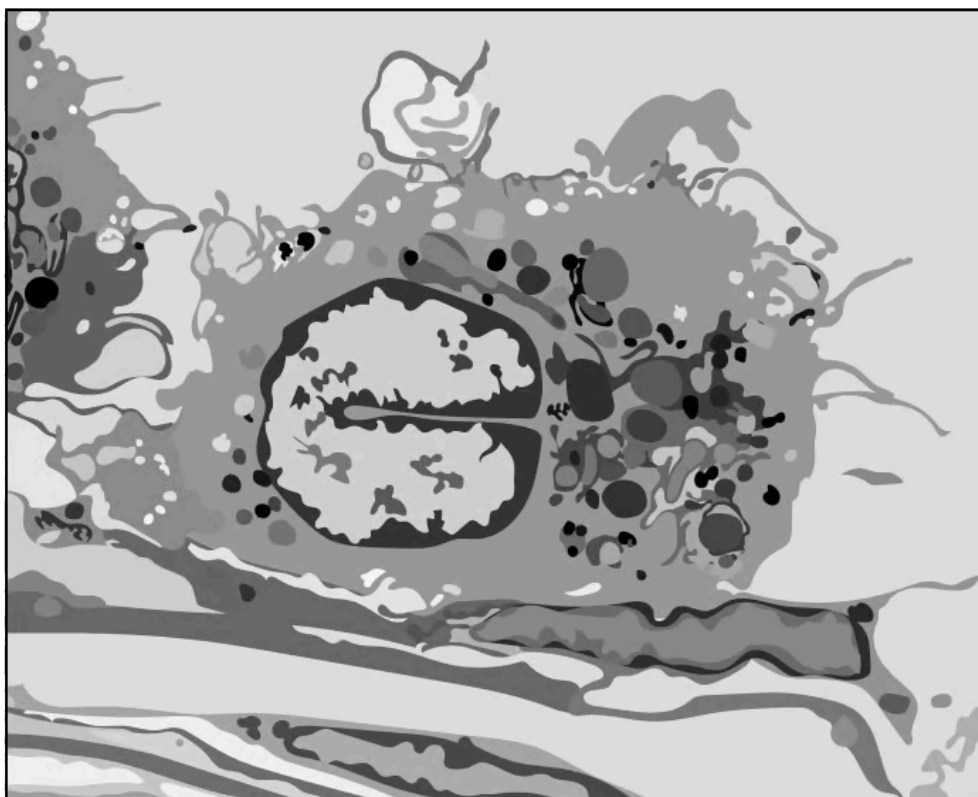
State the piece of apparatus that enabled scientists to examine the ultrastructure of cells.

(1 mark)

(c) List **two** structures found in both prokaryotic and eukaryotic cells.

(2 marks)

4 (a) Outline, with a reason, the function of the specialised cell shown below.



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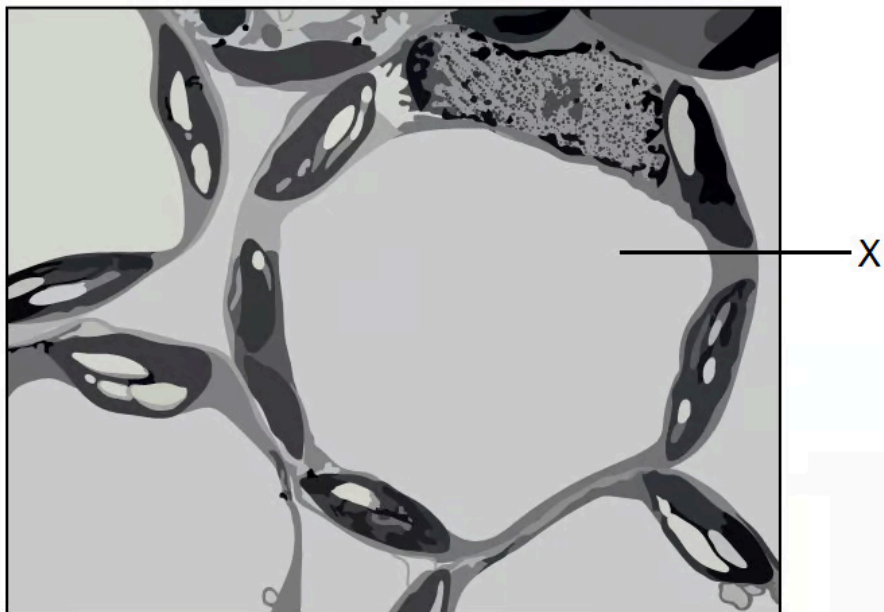
(3 marks)

(b) State which cell structure is shown below.



(1 mark)

(c) State the name the structure labelled X.



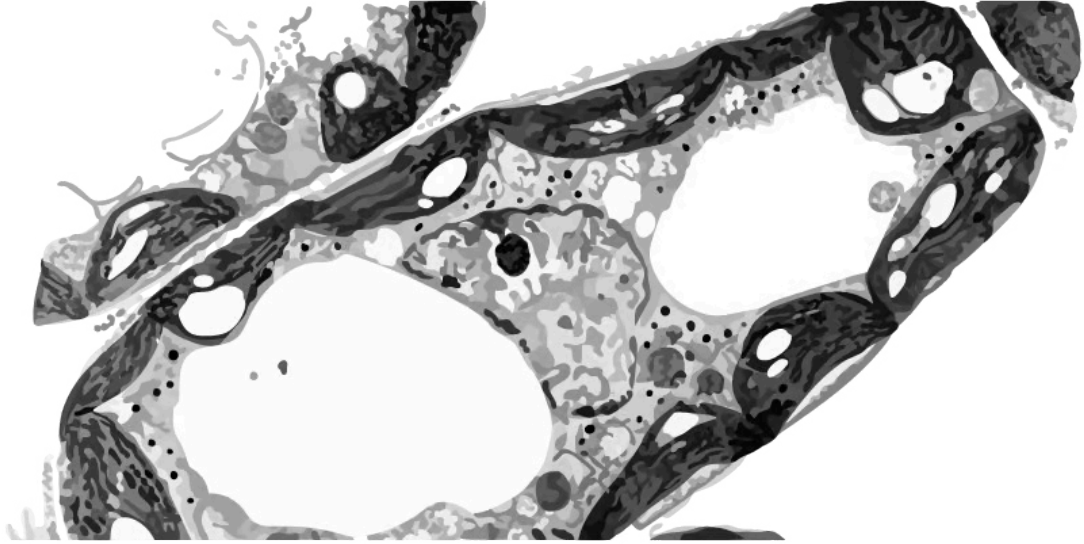
(1 mark)

One mark is available for clarity of communication throughout this question.

5 (a)

micrograph of a palisade mesophyll cell.

The diagram below shows an electron



Draw a labelled diagram of this cell.

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(5 marks)

(b) Outline the evidence scientists have provided to explain the origin of eukaryotic cells.

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(4 marks)

(c) Outline the experiment used by Pasteur to demonstrate cells only come from pre-existing cells.

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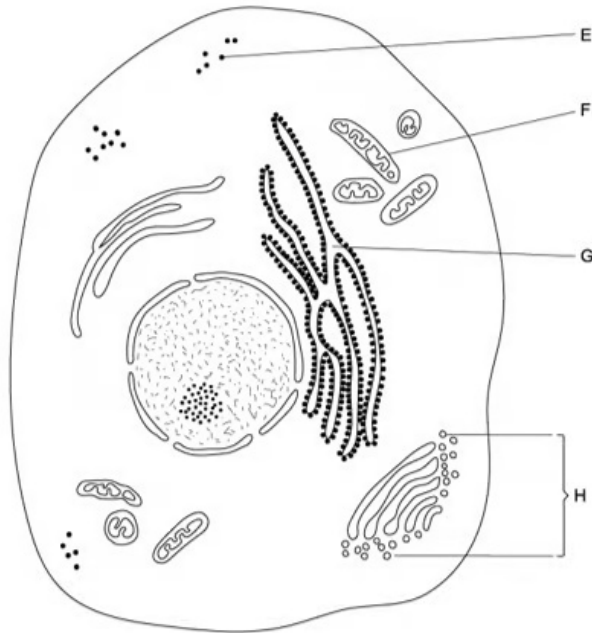
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(6 marks)

Medium Questions

1 (a) A student drew a eukaryotic cell based on what they saw in an electron micrograph.



Identify **F** and **H** in the student's drawing.

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(2 marks)

(b) The student concluded that the eukaryotic cell in part (a) was not a plant cell.

State why they came to this conclusion.

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(2 marks)

(c) One scientific theory suggests that mitochondria are organelles that evolved from prokaryotic cells.

Outline **two** pieces of evidence from mitochondria that support this theory.

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(2 marks)

(d) State the function that mitochondria provide to the cells that contain them.

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(2 marks)

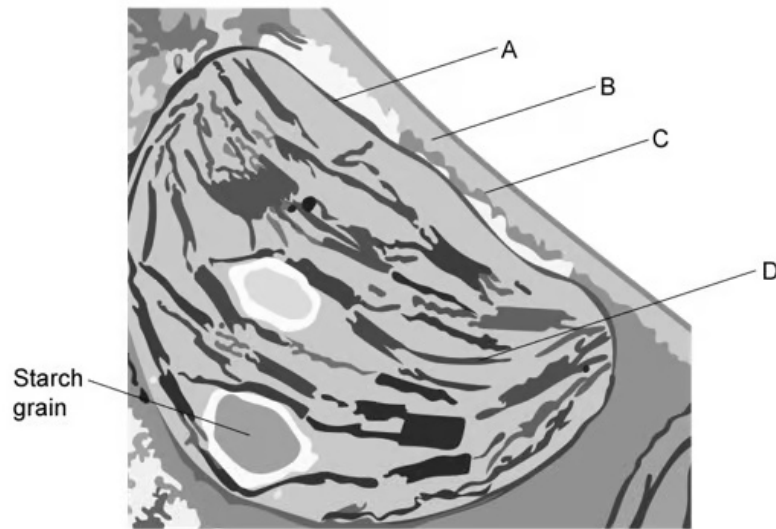
2 (a) The following statement describes some of Louis Pasteur's findings:

Broth was first boiled, killing all organisms in it. The broth was then transferred to a swan-necked flask, which prevented organisms from entering. The result was that no organism subsequently grew in the broth. The swan-necked flask was then broken. The result was that the broth subsequently went cloudy, indicating the growth of microorganisms

Explain what these findings demonstrated.

(1 mark)

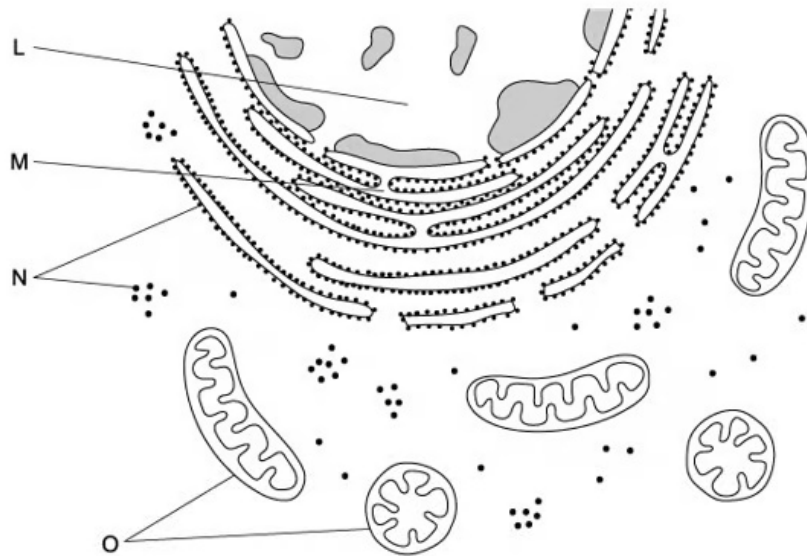
(b) The electron micrograph below shows part of a palisade mesophyll cell.



Identify structures **A** and **D**

(2 marks)

(c) The diagram below shows a drawing of part of an animal cell as seen through an electron microscope.



Suggest why the shapes of the two organelles labelled **O** in the diagram appear different.

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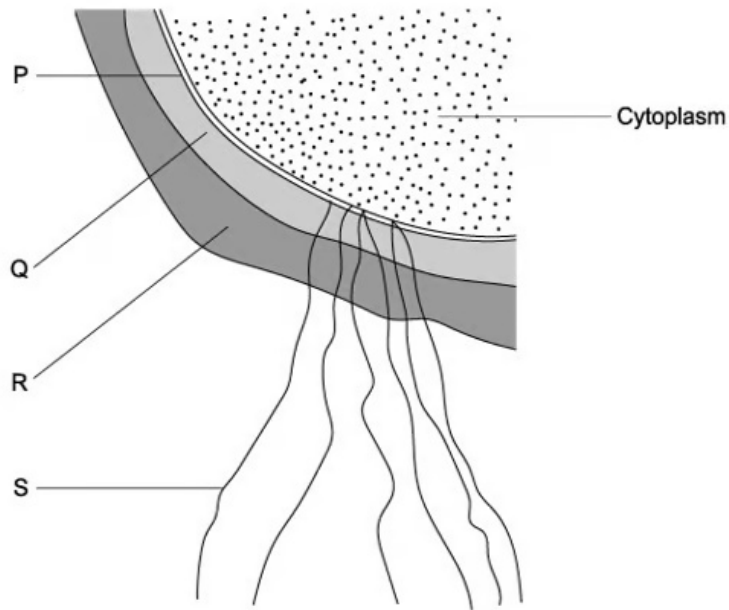
(2 marks)

(d) State the function of organelle **N** in the diagram in part (c).

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(1 mark)

3 (a) Phospholipids and peptidoglycan are two biological molecules, each of which are the main constituent of structures found in prokaryotic cells. The drawing below shows part of a prokaryotic cell.



(i) Identify (**P, Q, R, or S**) and name the structure in which phospholipids are the main biological molecule.

(ii) Identify (**P, Q, R, or S**) and name the structure in which peptidoglycan is the main biological molecule.

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(4 marks)

(b) In certain conditions some prokaryotic cells can divide every 25 minutes.

With a starting population of 2.45×10^3 cells, and assuming each cell divides every 25 minutes, calculate how many cells there will be after 3.75 hours. Assume no cells die during this time.

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(2 marks)

(c) Identify structure **R** in the diagram in part (a).

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(1 mark)

- 4 (a) Scientists used an electron microscope rather than an optical microscope to study the structure of a unicellular, eukaryotic organism known as an amoeba.

Explain why scientists used an electron microscope to study the structure of an amoeba.

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(2 marks)

- (b) State **three** structures in the amoeba cell that the scientists would not have been able to identify using a light microscope.

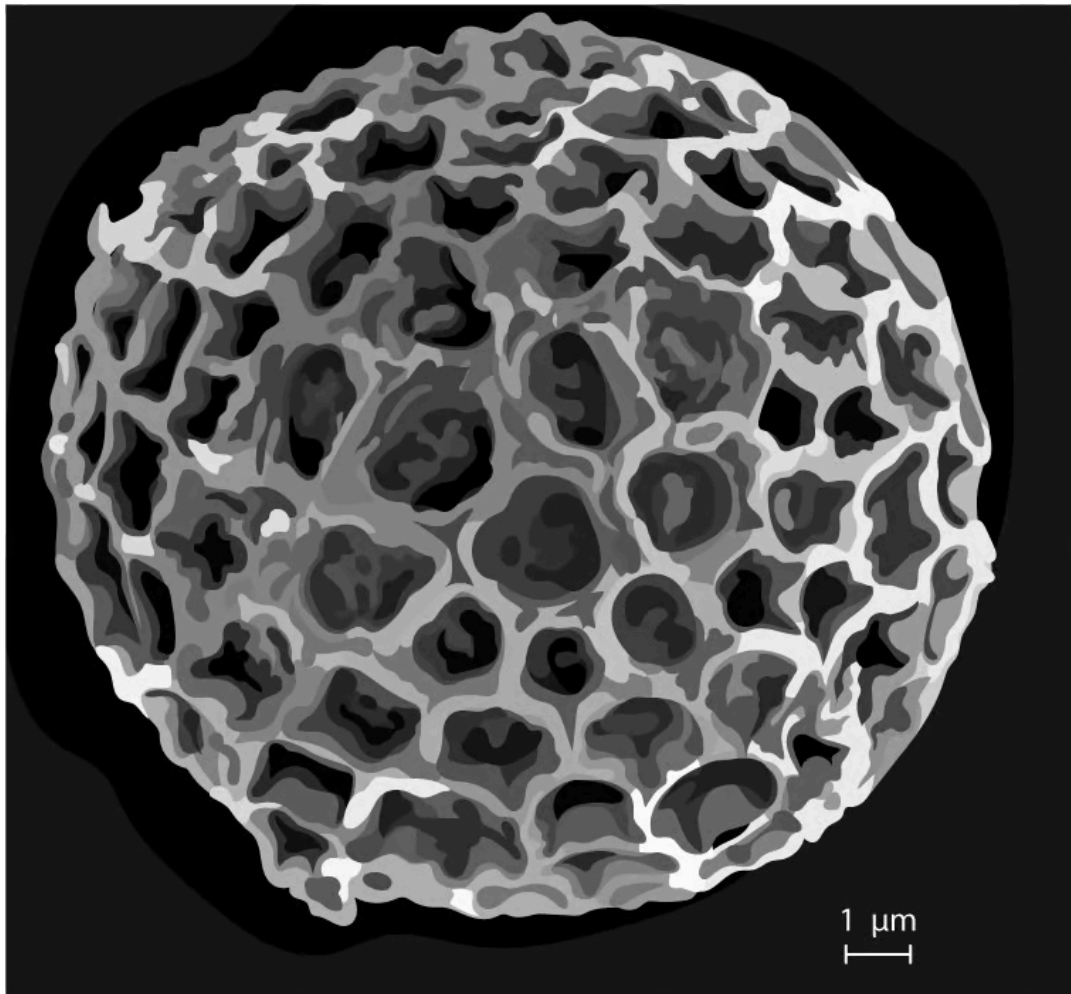
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(3 marks)

- (c) The electron micrograph below is of a spore from a fungus (*Tilletia controversa*), that affects wheat crops.

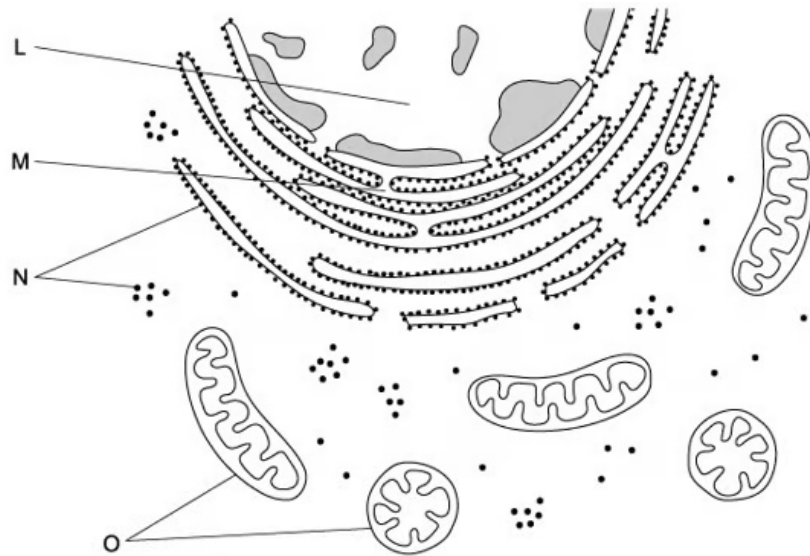


Identify, with a reason, whether the electron micrograph above was produced using a transmission electron microscope (TEM) or a scanning electron microscope (SEM).

(2 marks)

5 (a) One mark is available for clarity of communication throughout this question.

The diagram below shows a drawing of part of an animal cell as seen through an electron microscope.



Large numbers of organelle **O** are found in small intestine epithelial cells. Explain why these cells are adapted in this way.

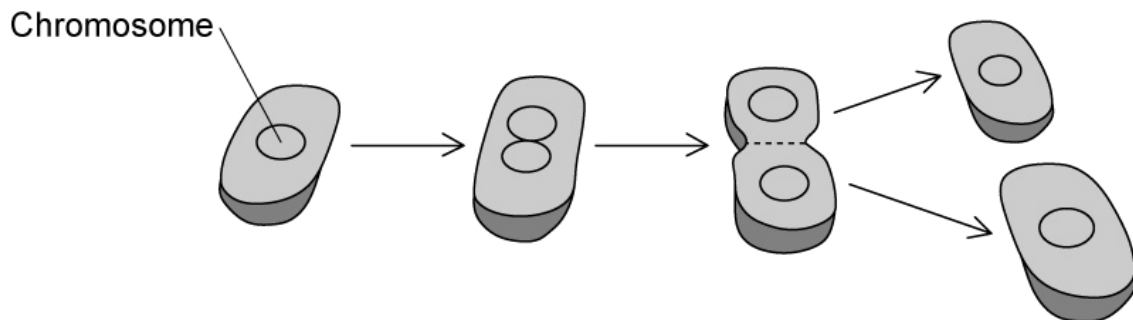
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(3 marks)

(b) Describe the process shown in the diagram below.



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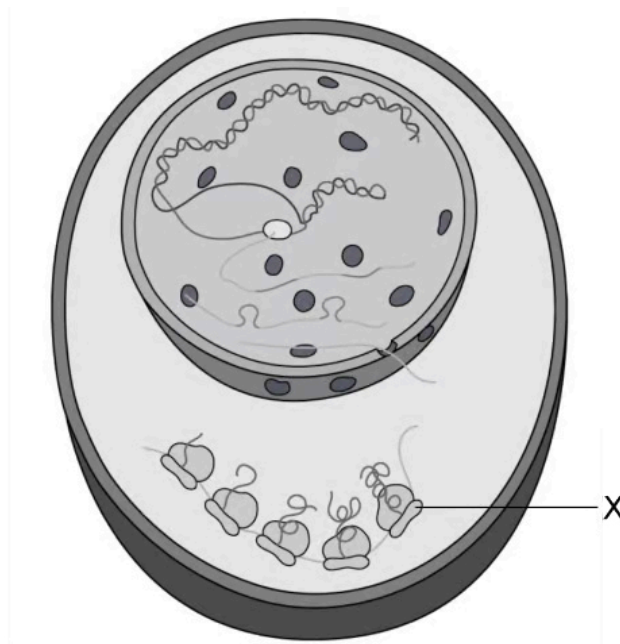
(5 marks)

(c) Compare and contrast the structures of prokaryotic and eukaryotic cells.

(7 marks)

Hard Questions

1 (a) The diagram below is a drawing of an electron micrograph of a cell.



Determine, with a reason, whether the cell is a eukaryotic cell.

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(2 marks)

(b) Outline why compartmentalisation is an advantage for this cell.

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(2 marks)

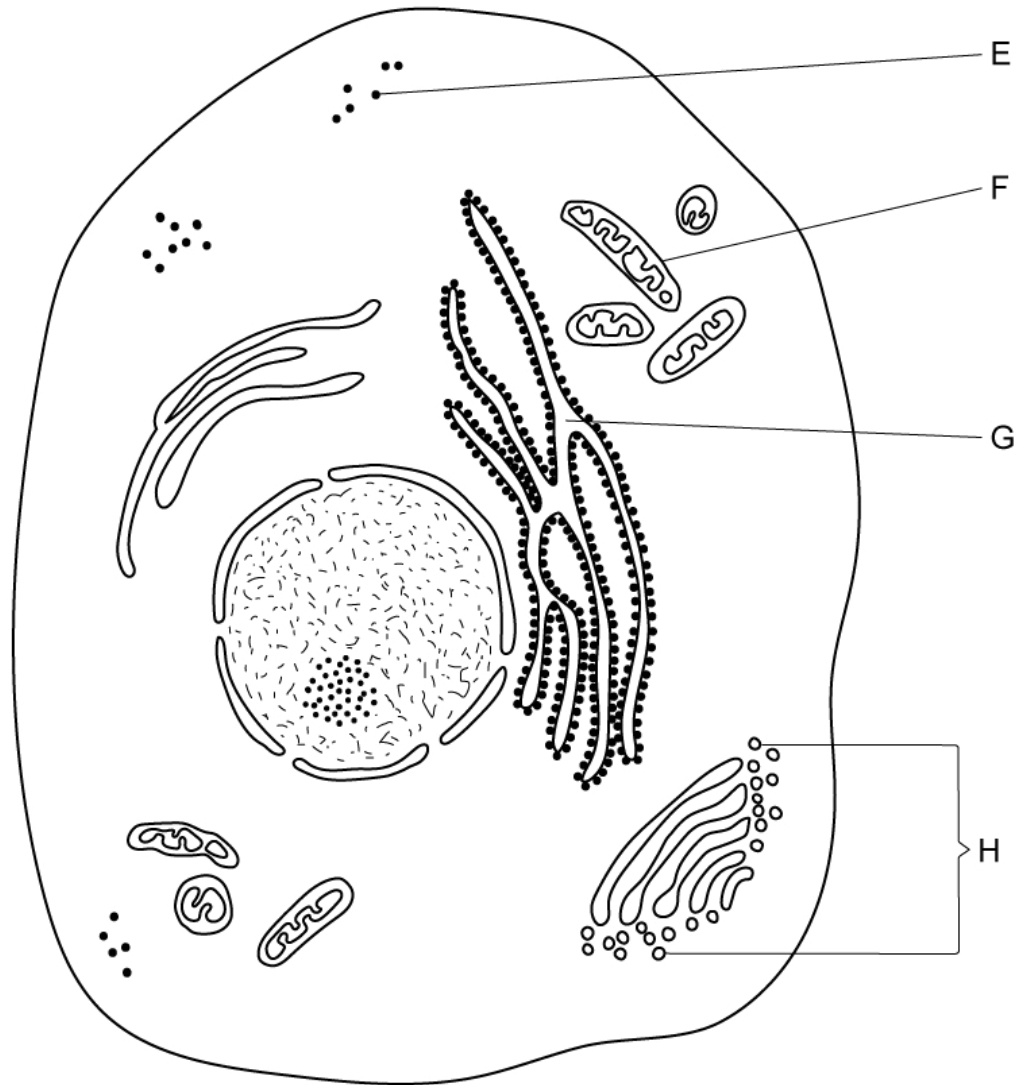
(c) During class, a student was examining structure X in the cell shown in part (a), and suggested that they could clearly see every detail at the highest magnification with their light microscope.

Explain why the student is not correct.

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(2 marks)

2 (a) A student drew this eukaryotic cell.



Identify the structures **E** and **G**.

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(2 marks)

(b) Distinguish between the function of the structures identified in part (a).

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(2 marks)

(c) Spontaneous generation was once the widely accepted theory explaining the origin of life. It is now universally accepted that cells come from pre-existing cells.

Outline the evidence that has allowed this change in universal acceptance.

(3 marks)

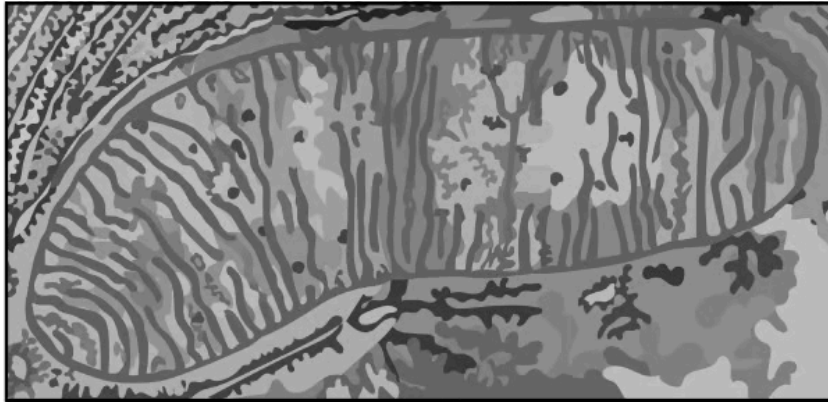
(d) Miller and Urey's experiments recreated the conditions thought to have existed on Earth prior to life.

Explain how the apparatus they used provided evidence for how the first cells could have formed.

(3 marks)

3 (a) Below are three electron micrographs showing organelles found within a cell.

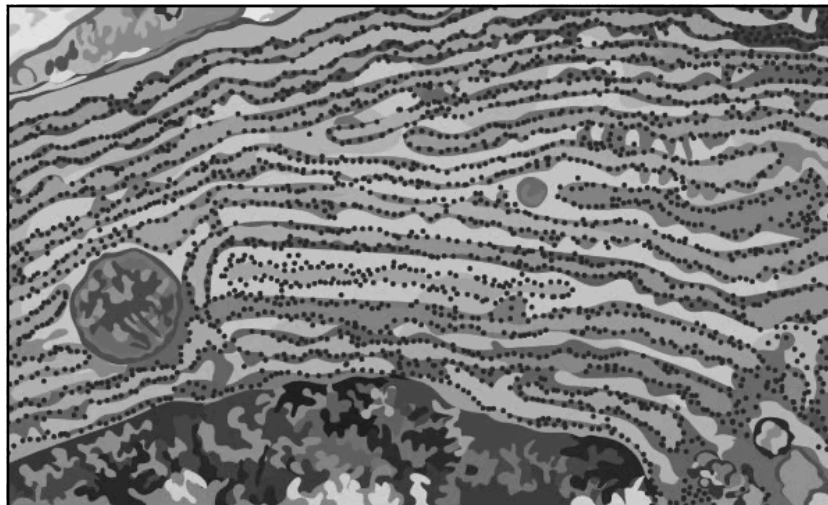
J



K



L



(i) Identify the organelles J, K, and L.

[3]

(ii) Suggest how the structure of these organelles enables them to function efficiently.

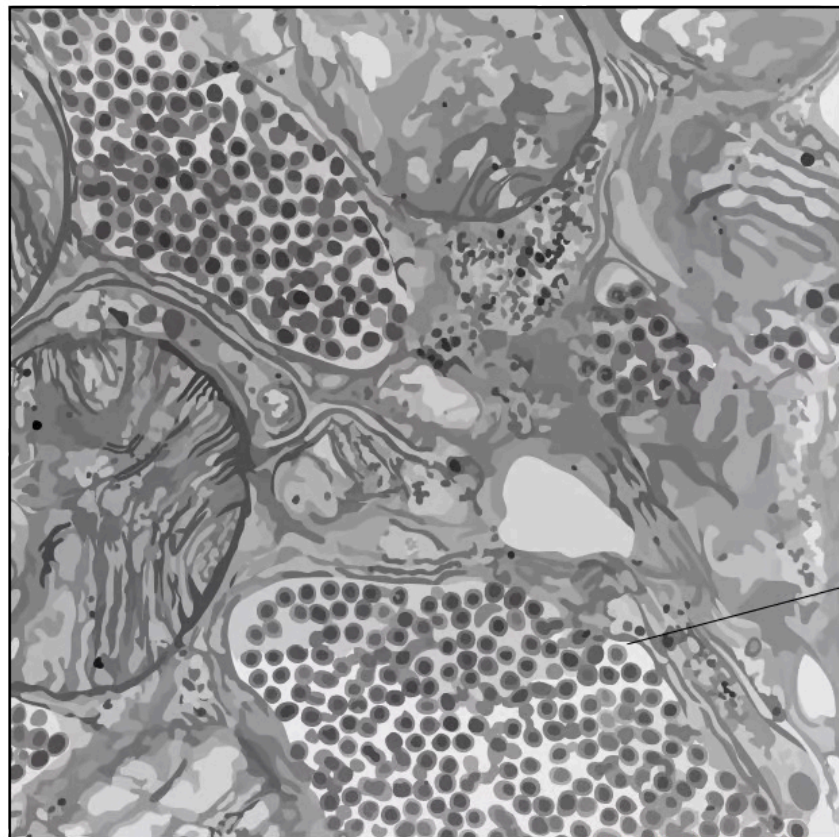
[1]

(4 marks)

(b) Compare the structure and function of the organelles in micrographs **K** and **L**.

(2 marks)

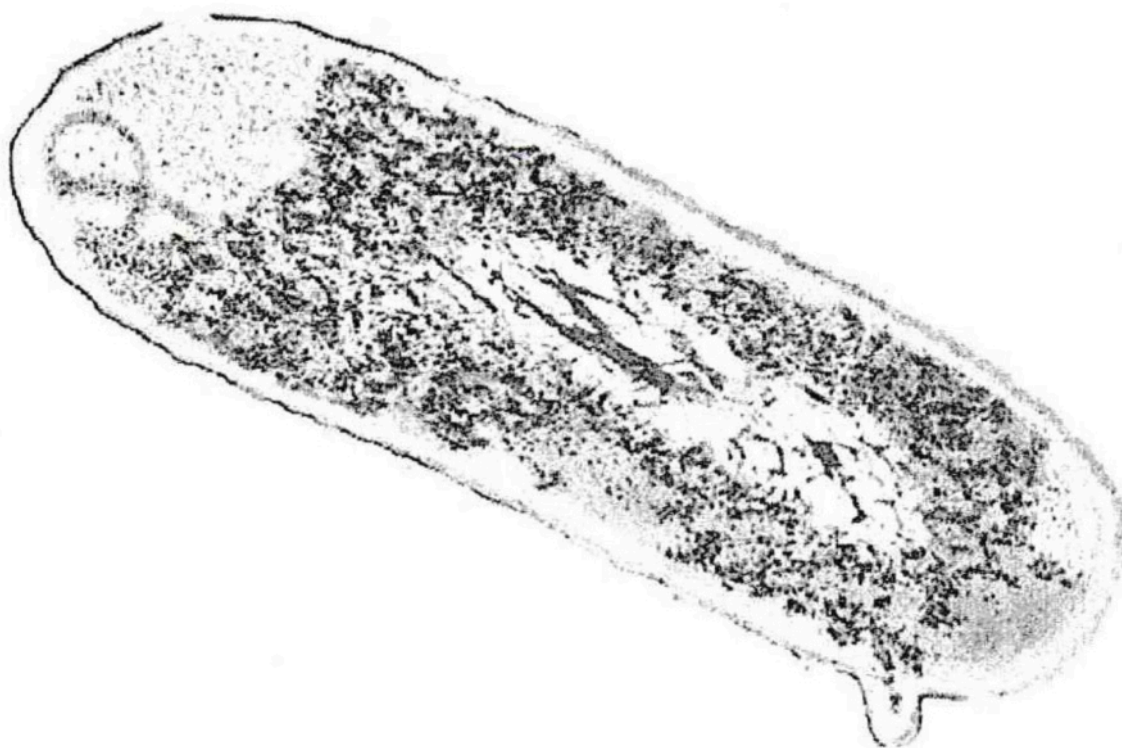
(c) The electron micrograph below is of a salivary gland of a mosquito.



Identify the structures labelled **P**.

(1 mark)

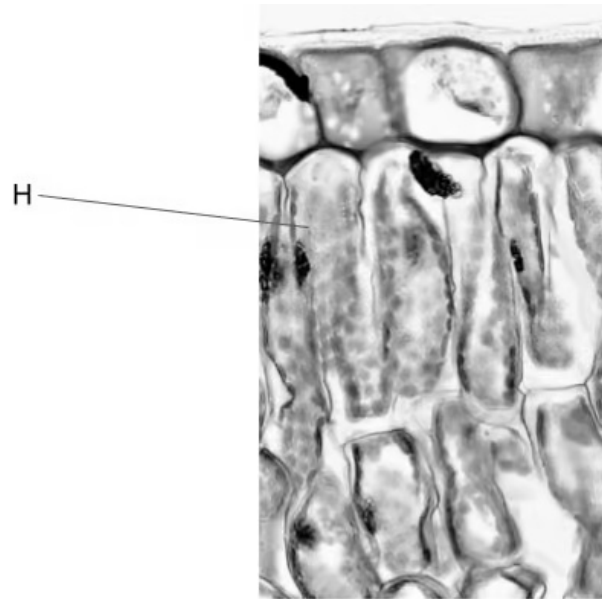
4 (a) Draw a labelled biological diagram of the bacterial cell below.



Pradana Aumars, CC0, via Wikimedia Commons

(3 marks)

(b) The image below is an electron micrograph of some cells.



https://upload.wikimedia.org/wikipedia/commons/thumb/4/4d/Angiosperm_Morphology_Adaxial_Epidermis_in_Ligustrum_%2836845195186%29.jpg/800px-Angiosperm_Morphology_Adaxial_Epidermis_in_Ligustrum_%2836845195186%29.jpg?20180623001402

Deduce, with a reason, the function of cell H.

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(2 marks)

(c) The image below is a 3D-printed model of a cell dividing.

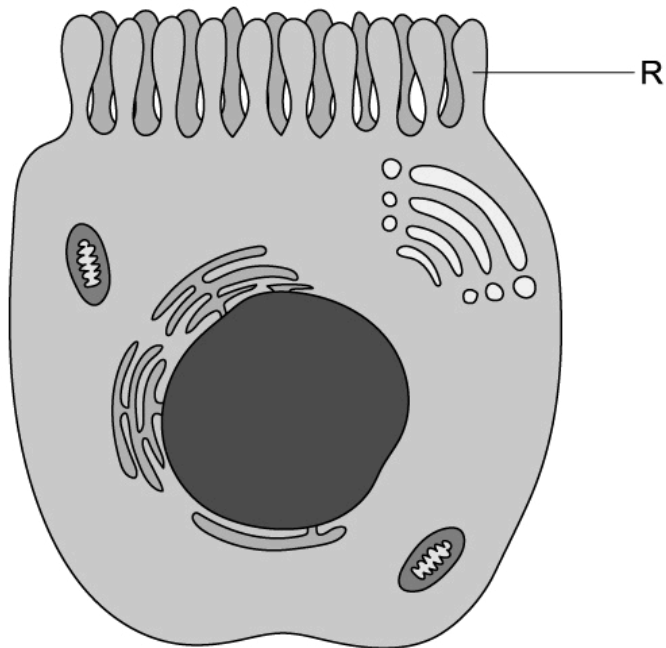


Rosser1954, CC BY-SA 4.0 <<https://creativecommons.org/licenses/by-sa/4.0/>>, via Wikimedia Commons

Deduce, with a reason, whether this model represents an animal cell, plant cell or neither.

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(d) This is an electron micrograph of an immune cell, responsible for specific immunity.



(i) Identify R

[1]

(ii) Deduce, with a reason, the function of this cell.

[3]

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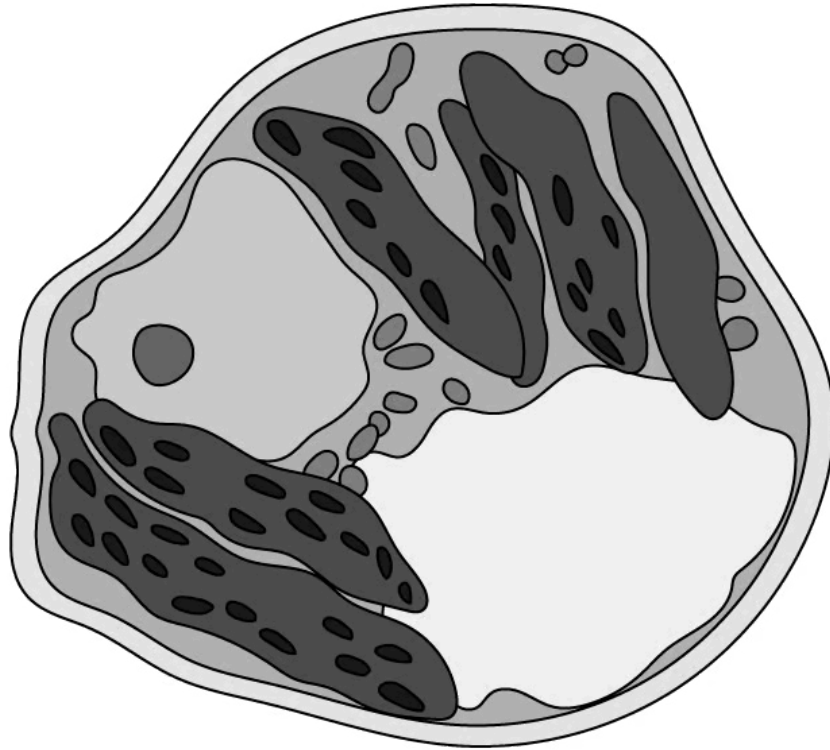
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(4 marks)

5 (a) One mark is available for clarity of communication throughout this question.

A student was examining this electron micrograph of a cell. They identified it as a plant cell.



Evaluate the student's decision to identify this as a plant cell.

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(3 marks)

(b) Explain the Oparin-Haldane hypothesis scientists proposed for the origin of the first cells.

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(5 marks)

(c) *Euglena gracilis* is a unicellular eukaryotic cell that is both heterotrophic and autotrophic.

Discuss the theory that suggests how an organism could have evolved to be a eukaryotic cell that is both heterotrophic and autotrophic.

(7 marks)