OCR AS GCE Biology *(20 pages)*

F211 Cells, Transport and Exchange

Exam questions from January 2009-June 2012

Topics:

Module 1 Cells: Cell structure, Cell diversity and cellular oganisation

State the resolution and magnification that can be achieved by a light microscope, a Transmission electron microscope and a scanning electron microscope
Explain the difference between magnification and resoolution
Explain the need for staining samples for use in light microscopy and electron microscopy
Calculate the linear magnification of an image
Describe and interpret drawings and photographs of eukaryotic cells as seen under an electron microscope and be able to recognize: nucleus, nucleolus, nuclear envelope, rough and smooth endoplasmic reticulum, golgi, ribosomes, mitochondria, lysosomes, chloroplasts,plasma membrane, centrioles, flagella and cilia
Outline the functions of the organelles listed in e)
Outline the interrelationship between the organelles involved in the production and secretion of proteins (no detail of protein synthesis is required);
Explain the importance of the cytoskeleton in providing mechanical strength to cells, aiding transport within cells and enabling cell movement;
Compare and contrast, with the aid of diagrams and electron micrographs, the structure of prokaryotic cells and eukaryotic cells;
Compare and contrast, with the aid of diagrams and electron micrographs, the structure and ultrastructure of plant cells and animal cells.
Define the term differentiation, with reference to the production of erythrocytes (red blood cells) and neutrophils derived from stem cells in bone marrow, and the production of xylem vessels and phloem sieve tubes from cambium;
Describe and explain, with the aid of diagrams and photographs, how cells of multicellular organisms are specialised for particular functions, with reference to erythrocytes (red blood cells), neutrophils, epithelial cells, sperm cells, palisade cells,root hair cells and guard cells;
Explain the meaning of the terms tissue, organ and organ system;
Explain, with the aid of diagrams and photographs, how cells are organised into tissues, using squamous and ciliated epithelia, xylem and phloem as examples;
Discuss the importance of cooperation between cells, tissues, organs and organ systems

Answer **all** the questions.

1 Fig. 1.1 is a diagram of an animal cell as seen using a transmission electron microscope.

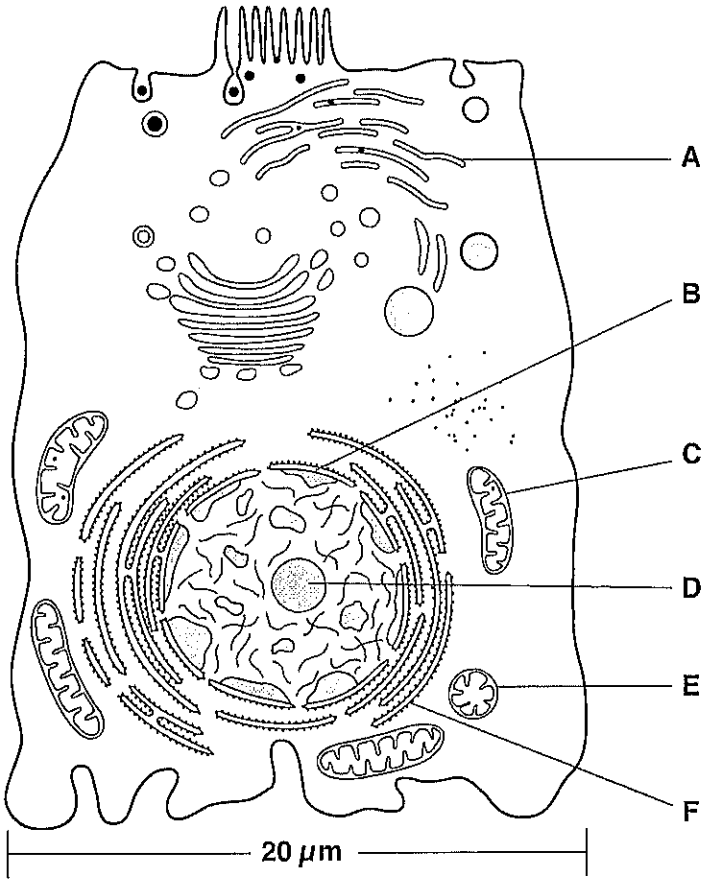

Fig. 1.1

(a) (i) Name the structures of the cell labelled **A**, **B**, **C** and **D**.

A .....

B .....

C .....

D ..... [4]

(ii) Structures **C** and **E** are examples of the same organelle.

Suggest why **E** looks so different to **C**.

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..... [2]

(iii) Calculate the actual length of structure **C**.

Show your working and give your answer in micrometres (μm).

Answer = ... μm **[2]**

(b) Proteins are produced by the structure labelled **F**. Some of these proteins may be **extracellular** proteins that are released from the cell.

Outline the sequence of events following the production of extracellular proteins that leads to their release from the cell.

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..... **[3]**

[Total: 11]

4 **(a)** Table 4.1 compares the structures of prokaryotic and eukaryotic cells.

Complete the table.

Table 4.1

prokaryotic	eukaryotic
no true nucleus	genetic material held in a nucleus
genetic material consists of 'naked' DNA	
average diameter of cell 0.5 – 5 μm	
	ribosomes about 22 nm in diameter
	cell wall sometimes present

[4]

(b) The cytoskeleton is an important component in the cytoplasm of all eukaryotic cells.

(i) Name **one** structure, **associated with the cytoskeleton**, which can bring about cell movement.

.....**[1]**

(ii) Suggest **two** processes **inside cells** that rely on the cytoskeleton for movement.

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.....**[2]**

[Total: 7]

Answer **all** the questions.

1 **(a)** State the maximum magnification that can be achieved by a light microscope and a transmission electron microscope.

Select your answers from the list below.

10x 40x 100x 400x 1500x 25 000x 50 000x 500 000x

light microscope x

transmission electron microscope ..... x [2]

(b) Describe what is meant by the term *resolution*.

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..... [2]

(c) Fig. 1.1 is an electron micrograph of xylem tissue in the stem of a plant.

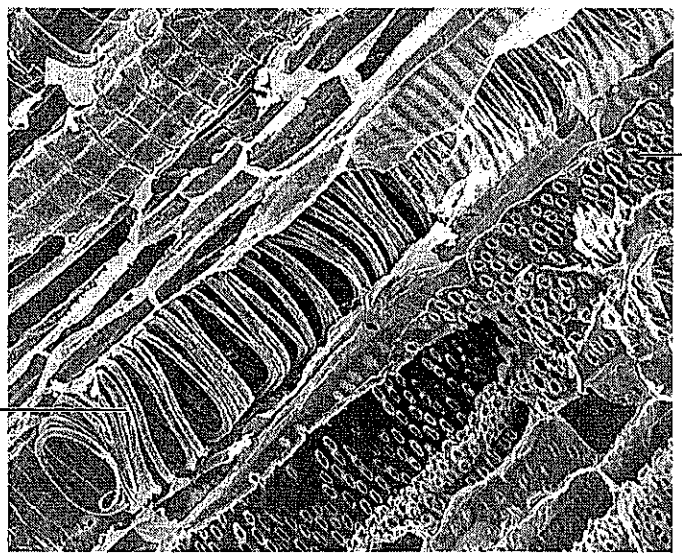

Fig. 1.1

(i) State **one** function of xylem tissue.

.....

..... [1]

(ii) The spiral band in the xylem vessel shown in Fig. 1.1 contains a substance called lignin.

State the function of this spiral band of lignin **and** explain why it is important that the xylem vessel becomes lignified in this way.

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..... **[3]**

(iii) Explain the function of the pits seen in Fig. 1.1.

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..... **[2]**

[Total: 10]

Answer **all** the questions.

1 **(a)** Fig. 1.1 is a diagram of a bacterium as seen under an electron microscope.

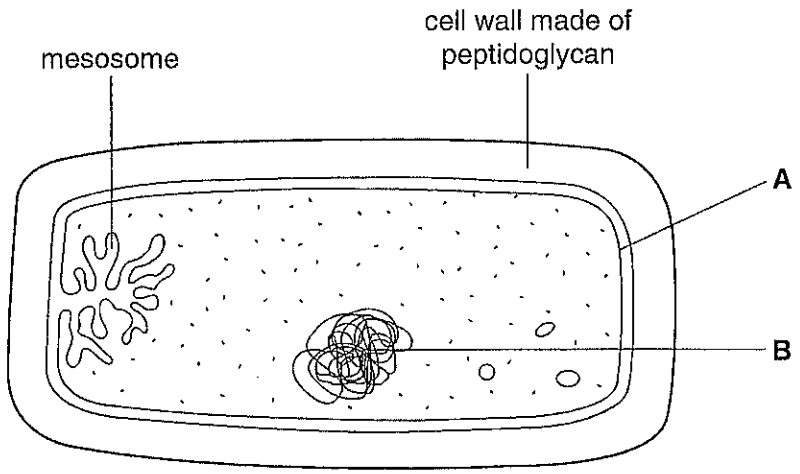

Fig. 1.1

(i) Name the structures labelled **A** and **B**.

A .....

B ..... [2]

(ii) It has been suggested that the mesosome has the same role as mitochondria in eukaryotic cells.

Suggest the role of the mesosome in prokaryotic cells, such as bacteria.

..... [1]

(iii) Eukaryotic cells, such as *Euglena*, contain membrane-bound organelles. Each organelle has a specific function in the cell.

State the **process** that is carried out in each of the organelles listed below.

ribosome .....

chloroplast ..... [2]

(b) Explain why a single-celled organism, such as *Euglena*, does **not** need a specialised area to carry out gaseous exchange.

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..... [2]

4 Fig. 4.1 shows diagrams of two different types of cells, **X** and **Y**.

The cells are **not** drawn to scale.

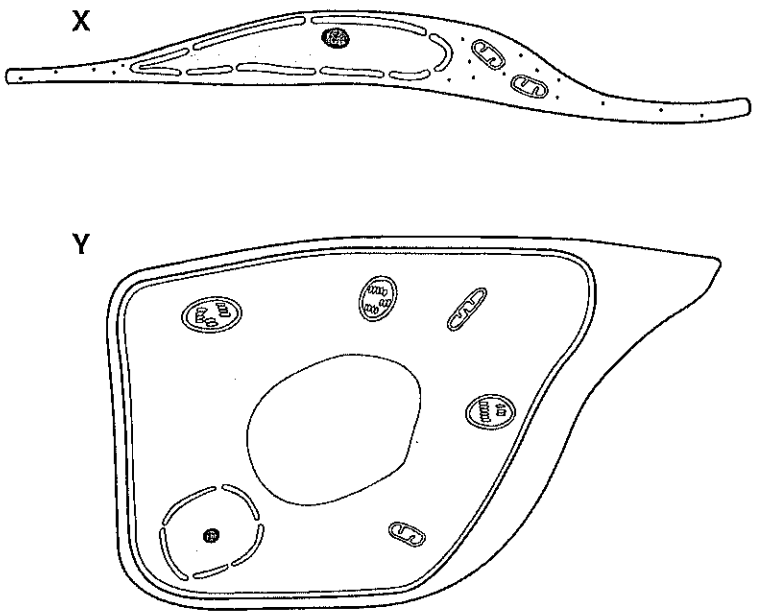

Fig. 4.1

(a) (i) State, using **only the information in Fig. 4.1**, two **differences** between plant cells and animal cells.

1 .....

.....

2 .....

..... **[2]**

(ii) Cell **Y** is a guard cell.

State, using **only the information in Fig. 4.1**, one adaptation of this cell and explain how the adaptation allows the cell to carry out its function.

adaptation .....

explanation .....

.....

..... **[2]**

5 (a) Fig. 5.1 is provided for you **on the insert.**

(i) State **two** features of the cell shown in Fig. 5.1 that indicate it is eukaryotic.

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.....

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..... [2]

(ii) The line **A–B** on Fig. 5.1 represents 20 μm.

Calculate the magnification of the cell shown in Fig. 5.1.

Show your working.

Answer = ... x [2]

(iii) Microtubules and microfilaments are part of the cytoskeleton.

Suggest **two** roles of the cytoskeleton in the type of cell shown in Fig. 5.1.

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..... [2]

(b) The cells of a multicellular organism are usually specialised to perform a particular function.

(i) Name the process in which a cell becomes specialised.

..... [1]

(ii) Neutrophils are phagocytic blood cells that can engulf and digest foreign cells found in the blood.

Describe how the **ultrastructure** of a neutrophil is specialised to enable it to perform this function.

In your answer, you should use appropriate technical terms, spelt correctly.

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..... **[4]**

[Total: 11]

Answer **all** the questions.

1 **(a)** Fig. 1.1, **on the insert**, shows an electron micrograph of cells from the liver.

(i) Some cells, such as liver cells, contain a lot of Golgi apparatus.

State **one** function of the Golgi apparatus.

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..... [1]

(ii) Suggest why the nuclear envelope contains pores.

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..... [2]

(iii) State the function of the lysosomes.

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..... [1]

(b) The liver is an organ.

Explain what is meant by the term *organ*.

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..... [2]

2 **(a)** Complete the following paragraph about cells by using the most appropriate term(s).

Cells that are not specialised but still have the ability to divide are called

..... cells. Such cells can be found in the

..... of the long bones of mammals. These cells can

..... into other types of cell, such as erythrocytes that carry

oxygen in the blood. In plants, ... tissue also contains cells

that are not specialised. **[4]**

(b) Sponges are simple eukaryotic multicellular organisms that live underwater on the surface of rocks.

Sponges have a cellular level of organisation. This means that they have no tissues.

Each cell type is specialised to perform a particular function.

One type of cell found in a sponge is a collar cell. Collar cells are held in position on the inner surface of the body of the sponge.

Fig. 2.1 is a diagram showing a vertical section through the body of a sponge and an enlarged drawing of a collar cell.

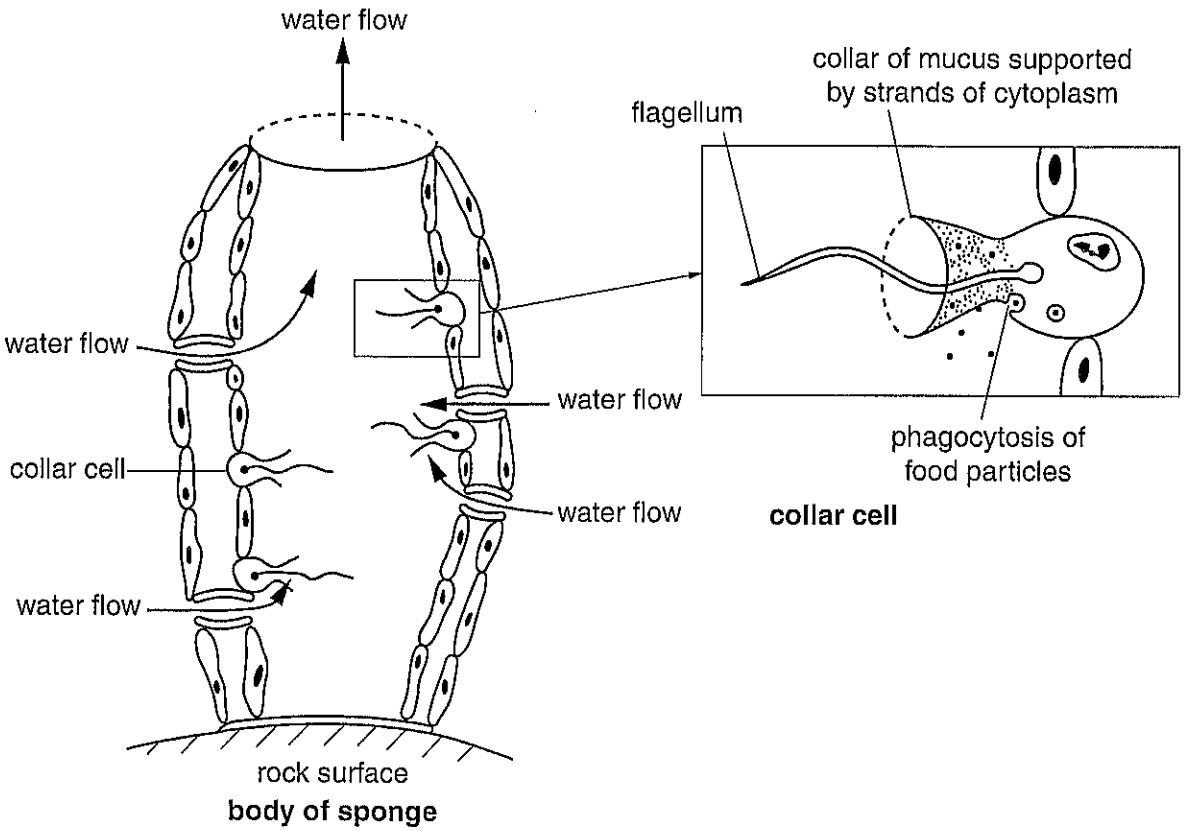

Fig. 2.1

(i) Suggest **one** function of the flagellum in the collar cell.

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..... [1]

(ii) Suggest **one** possible role for the collar of mucus in the cell.

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..... [1]

(c) In more advanced organisms, cells are organised into tissues consisting of one or more types of specialised cells.

Describe how cells are organised into tissues, using **xylem** and **phloem** as examples.

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..... [4]

[Total: 10]

4 The use of microscopy has greatly enhanced our knowledge of cell structure.

(a) Explain the difference between *magnification* and *resolution*.

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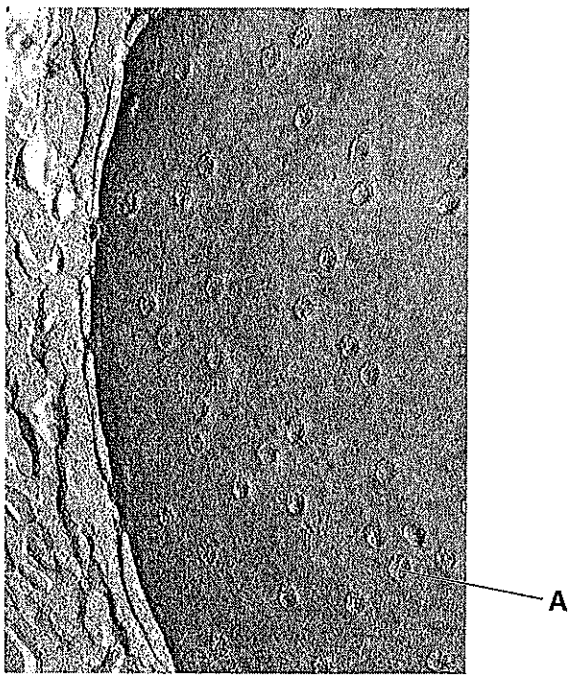
..... [2]

(b) State the resolution that can be achieved by each of the following types of microscope.

light microscope .....

transmission electron microscope ..... [2]

(c) Fig. 4.1 is an electron micrograph showing part of a nucleus.



x 25000

Fig. 4.1

(i) A student stated that Fig. 4.1 was taken using a scanning electron microscope.

What evidence supports the student's statement?

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..... [1]

(ii) On Fig. 4.1, the nuclear pore complex, labelled **A**, is 3 mm wide.

Calculate the actual diameter of the pore, in nanometres.

Answer = ... nm [2]

(iii) State the function of the nuclear pores.

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..... [1]

(d) State **two** features of a eukaryotic cell, other than nuclear pores, that would **not** be visible using medium power of a light microscope.

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..... [2]

[Total: 10]

6 Membranes are a fundamental part of the cell. They are found both at the surface of a cell and inside a cell.

(a) State **three** roles of membranes **inside** cells.

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..... [3]

(b) Cells contain a large number of membrane-bound vesicles. Many of these vesicles transport substances between organelles.

(i) Outline how the vesicles are moved from one organelle to another.

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..... [2]

(ii) The proteins embedded in the membranes of vesicles have different functions.

- COPI and COPII proteins are known as 'address proteins'.
- Vesicles that transport materials from the Golgi to the rough endoplasmic reticulum (RER) are coated in COPI proteins.
- Vesicles that transport materials to the Golgi from the RER are coated in COPII proteins.

Suggest how these proteins ensure that a vesicle is transported to the correct target organelle.

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..... **[2]**

(c) Cells in the pancreas secrete proteins such as the enzymes pancreatic amylase and protease.

Describe how these extracellular enzymes are secreted from the cells.

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..... **[2]**

[Total: 9]

END OF QUESTION PAPER

(c) In most multicellular organisms, the cells produced by cell division are organised into tissues.

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

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..... **[2]**

(ii) Complete Table 1.1 below comparing two types of epithelium, squamous epithelium and ciliated epithelium.

For each type of epithelium, state **one** function of the tissue and **one** specific location in the human body where it is found.

Table 1.1

type of epithelium	function of tissue	specific location in the human body
squamous		
ciliated		

[4]

[Total: 12]

2 Fig. 2.1 is a diagram of a cell showing the organelles involved in the production and secretion of an extracellular protein. The rough endoplasmic reticulum (RER) is shown enlarged at the side of the diagram.

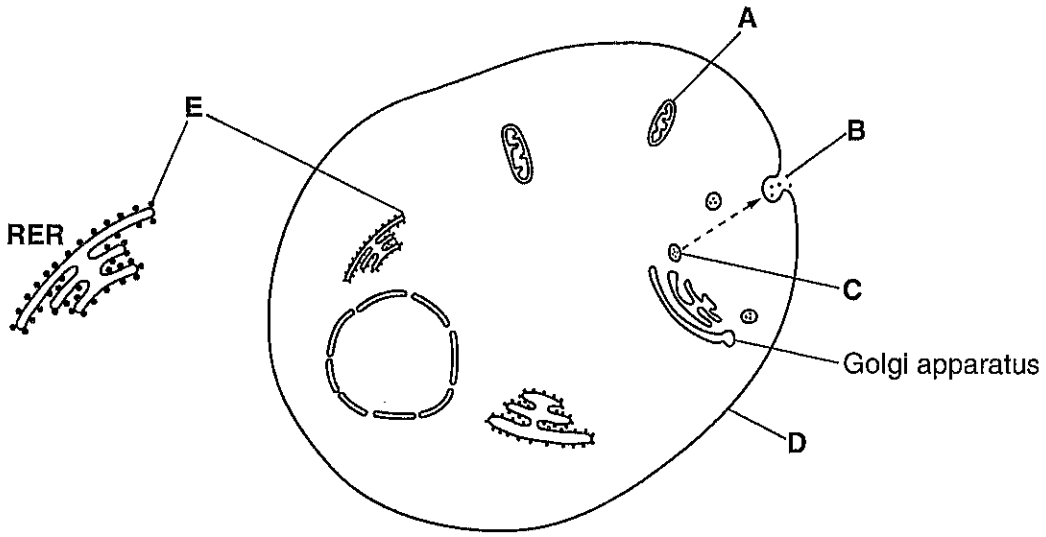

Fig. 2.1

(a) (i) Name the structures labelled **C**, **D** and **E**.

C .....

D .....

E ..... **[3]**

(ii) Suggest **one** type of extracellular protein secreted at **B**.

..... **[1]**

(iii) Organelle **A** provides ATP which is a source of energy.

Suggest **one** stage during the secretion of a protein that requires energy.

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..... **[1]**

(iv) Outline the role of the Golgi apparatus.

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..... **[2]**

(b) The cell shown in Fig. 2.1 is a eukaryotic cell.

(i) Identify **two** features, **visible in Fig. 2.1**, which would **not** be present in a prokaryotic cell.

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..... **[2]**

(ii) Name **one** feature that would be present in the cytoplasm of a prokaryotic cell that is **not** found in a eukaryotic cell.

..... **[1]**

[Total: 10]