Cell Structure

Model Answers 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Foundations in Biology
Topic	Cell Structure
Booklet	Model Answers 2

Time allowed: **38 minutes**

Score: **/28**

Percentage: **/100**

Grade Boundaries:

A*	A	B	C	D	E
>69%	56%	50%	42%	34%	26%

Question 1

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

(a) Explain the difference between *magnification* and *resolution*. **[2]**

- Magnification is the **number of times larger the image is compared to the object**
- Resolution is the **degree of detail** that can be seen in terms of the degree to which you can **distinguish between two points**

***Exam tip**: these are quite difficult to explain, so it is best that you **learn** these definitions.*

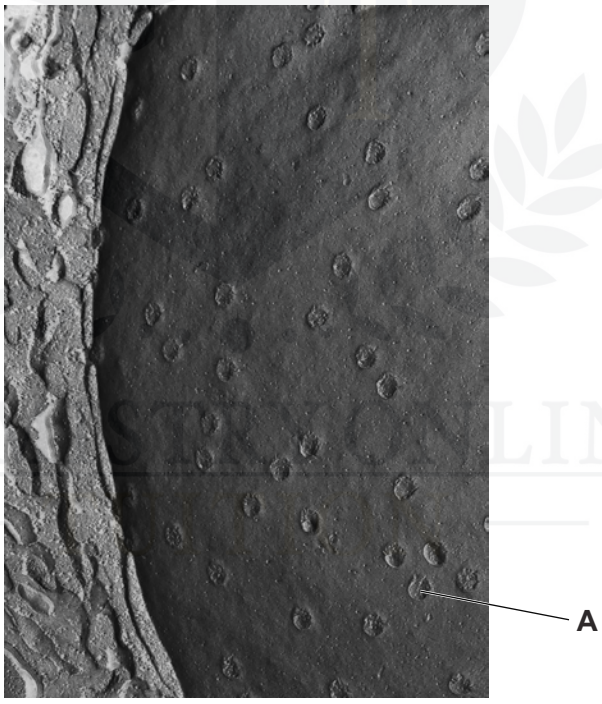
(b) State the resolution that can be achieved by each of the following types of microscope. **[2]**

light microscope ..... 50-200 nm .....

transmission electron microscope ..... 0.05-1.0 nm .....

Learn these facts!

(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? **[1]**

You can tell that Fig 4.1 was taken with a scanning electron microscope because

- it is a **3D image**
- it is the **surface** of the object

The images from a scanning electron microscope (SEM) are unique as the electrons do not pass through the object so the image received is a 3D image of the surface.

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

Calculate the actual diameter of the pore, in nanometres. **[2]**

- =120nm

3mm = 3000000nm

Actual size = image size/magnification

Therefore actual size = 3000000/25000 = 120nm

***Exam tip**: always show your working! Don't forget to convert so that all your numbers have the same units.*

Diagram to show the calculations for magnification questions:

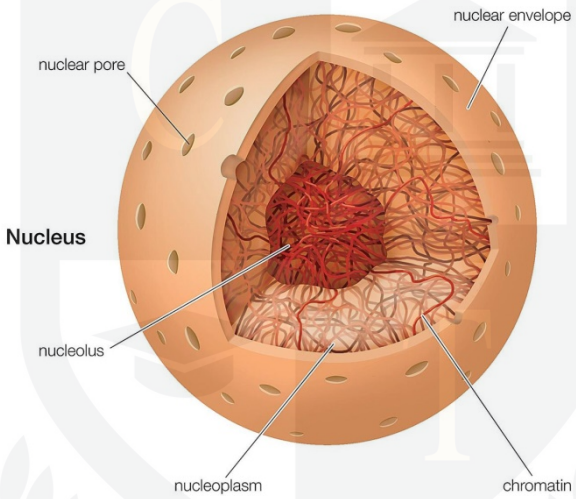
$$\text{Actual size} = \frac{\text{Image size}}{\text{Magnification}}$$

$$\text{Magnification} = \frac{\text{Image size}}{\text{Actual size}}$$

(iii) State the function of the nuclear pores. **[1]**

- Nuclear pores allow **communication between the nucleus and the cytoplasm**
- by allowing **molecules to enter and leave the nucleus**

Diagram to show the nucleus with nuclear membrane and pores:



(d) State **two** features of a eukaryotic cell, other than nuclear pores, that would **not** be visible using medium power of a light microscope. **[2]**

Two features of a eukaryotic cell that would not be visible under medium power are (any two of):

- phospholipid bilayer
- ribosomes
- Golgi
- endoplasmic reticulum / ER / RER / SER
- cytoskeleton / microtubules / microfilaments / spindle fibres
- centrioles
- vesicles / lysosomes
- mitochondria

[Total: 10]

Question 2

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

Complete the table. **[4]**

Table 4.1

prokaryotic	eukaryotic
no true nucleus	genetic material held in a nucleus
genetic material consists of 'naked' DNA	as chromosomes/ associated with histone proteins
average diameter of cell 0.5 – 5 µm	20-40 µm
18nm	ribosomes about 22 nm in diameter
cell wall present	cell wall sometimes present

Note: it would be wise to learn the sizes of an average eukaryotic cell and both eukaryotic and prokaryotic ribosome size. Remember that prokaryotes have cell walls made out of peptidoglycan. Eukaryotes include plants, animals, fungi and protists; therefore some have cell walls and some do not.

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

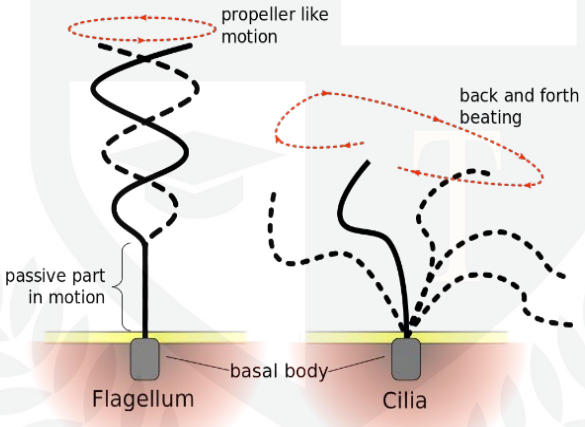
(i) Name **one** structure, **associated with the cytoskeleton**, which can bring about cell movement.

[1]

A structure that can bring about cell movement is (any one of):

- flagellum – these are structures which are used for locomotion, usually in prokaryotes
- cilium – these are extensions of the cytoplasm, that move to 'waft' substances
- undulipodium – this is the 'tail' of a sperm cell that projects the cell forward

Diagram of a flagellum and a cilium:

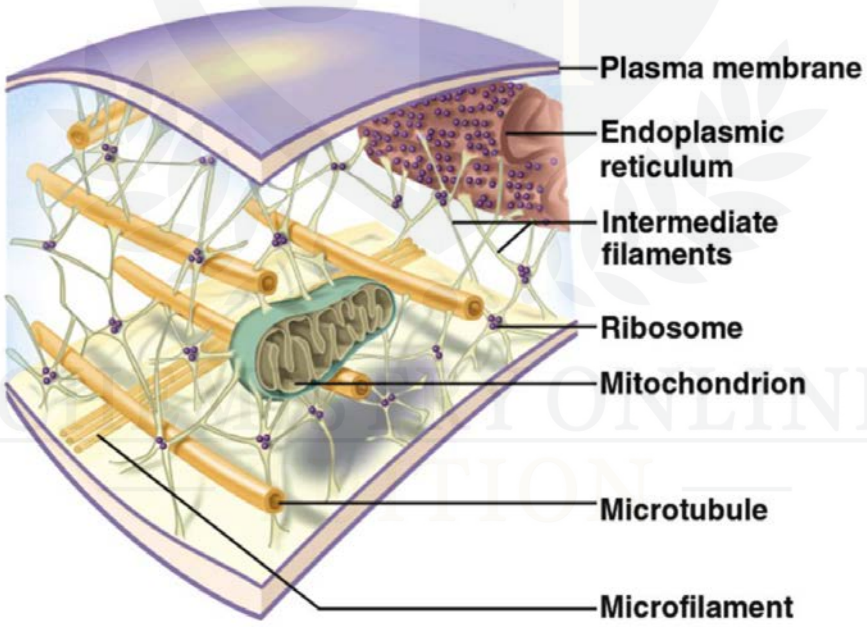


(ii) Suggest **two** processes **inside cells** that rely on the cytoskeleton for movement. **[2]**

Processes that rely on the cytoskeleton are:

- Chromosomes/ chromatid movement during cell division
- Splitting of the cytoplasm during cytokinesis
- Organelle movement
- RNA movement during protein synthesis
- Movement of proteins

Diagram to show how the cytoplasm links up all parts of the cell to help coordinate its functions:



[Total: 7]

Question 3

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

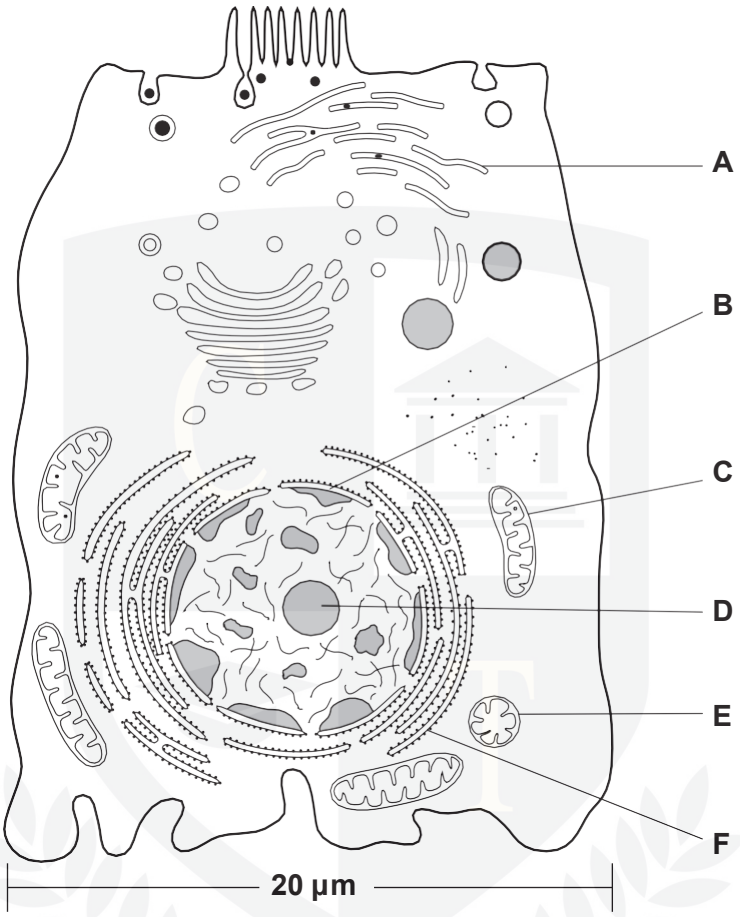


Fig. 1.1

(a) (i) Name the structures of the cell labelled **A**, **B**, **C** and **D**. **[4]**

A -Smooth Endoplasmic Reticulum

This organelle has no ribosomes and is therefore called 'smooth'.

B -Nuclear membrane

This membrane is a lipid bilayer and surrounds the nucleus.

C -Mitochondrion

This is where respiration occurs.

D -Nucleolus

A round structure inside the nucleus which contains proteins and RNA.

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

Suggest why **E** looks so different to **C**. **[2]**

These organelles are mitochondria.

E and C look different because:

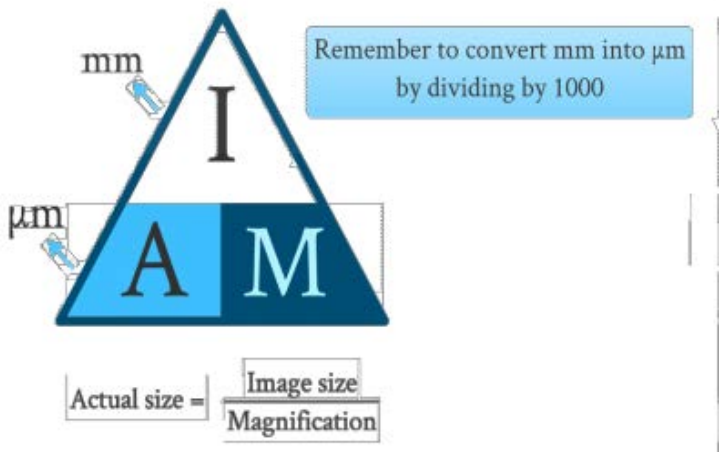
- They vary in shape
- They may be longer than they are wide
- They may have been cut on different planes
- They may have just divided and be growing
- This may be a section of mitochondria damaged during preparation

***Exam tip**: this is a 'suggest' question. This means that you will not have specifically been taught this content. However, you will be expected to recognise this as a mitochondrion, and therefore use your scientific knowledge to suggest any reasons why this may not look identical to the other organelles.*

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

Show your working and give your answer in micrometres (μm). **[2]**

Use the equation magnification:



Rearrange this: object size= measured size/magnification

The length of C in the image=15mm

Actual length = 20 x 15=300

300/80=3.75 micrometres

(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.

[3]

Extracellular proteins are released from the cell by:

- proteins are moved to Golgi apparatus
- there, they are modified
- into vesicles
- the vesicle is moved to the plasma membrane
- the vesicles fuse with the membrane
- are released by exocytosis

***Exam tip**: here, you **must** use the words underlined, in order to gain the mark for that bullet point. There is not a QWC mark available, however.*

[Total: 11]