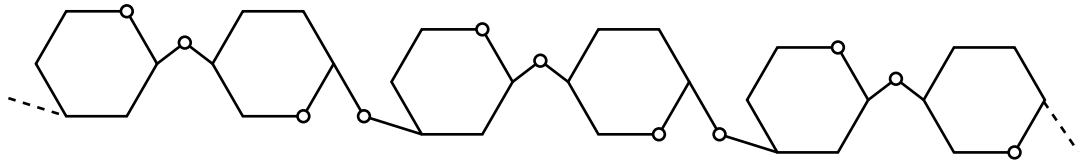
1 Fig. 4.1 shows a representation of part of a carbohydrate molecule called agarose.

One of the subunits of agarose is a sugar called galactose.



Identify the type of carbohydrate molecule of which the carbohydrate agarose is an example.

.....

Starch contains a carbohydrate called amylose. Amylose does not contain galactose.

Using the information in Fig. 4.1, identify similarity and difference in structure between agarose and amylose.

similarity .....

.....

.....

difference .....

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Agarose forms part of a more complex carbohydrate called agar, which is used as a growth medium for bacteria. Bacteria cannot break down the agarose in agar.

Suggest why bacteria cannot break down agarose.

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.....

A student wished to demonstrate experimentally that bacteria cannot break down agarose.

The student used a culture of *E.coli* bacteria which had been grown in a solution containing starch.

Two tubes, **A** and **B**, were set up as follows:

Tube **A**: contained 0.1 cm^3 of the *E.coli* culture and 5 cm^3 of a nutrient solution in which agarose was the only carbohydrate.

Tube **B**: contained 5 cm^3 of a nutrient solution in which agarose was the only carbohydrate.

Both tubes were incubated at 30 °C for 2 hours.

A sample from each tube was then tested for the presence of reducing sugar.

The results are shown in Table 4.1.

source of sample	conclusion from test
tube **A**	very small amount of reducing sugar present
tube **B**	no reducing sugar present

Explain the purpose of tube **B**.

.....

.....

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.....

The student wrote the following conclusion:

My experiment showed that bacteria must be able to break down agarose. This is because reducing sugar was present in tube ***A***.

Suggest an alternative explanation for the presence of reducing sugar in tube **A** that is consistent with the student's conclusion.

.....

.....

.....

Suggest ways in which the of the experiment could be improved.

1 .....

.....

2 .....

.....

The student did have access to a colorimeter when testing solutions for the presence of reducing sugar.

Describe how the student could carry out a chemical test for reducing sugar suggest how he could estimate the amount of reducing sugar in the sample from tube **A**.

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Another student suggested that the agarose may have been broken down to a sugar.

Describe how the test for reducing sugar could be modified to investigate this hypothesis.

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

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

.....

.....

.....

.....

.....

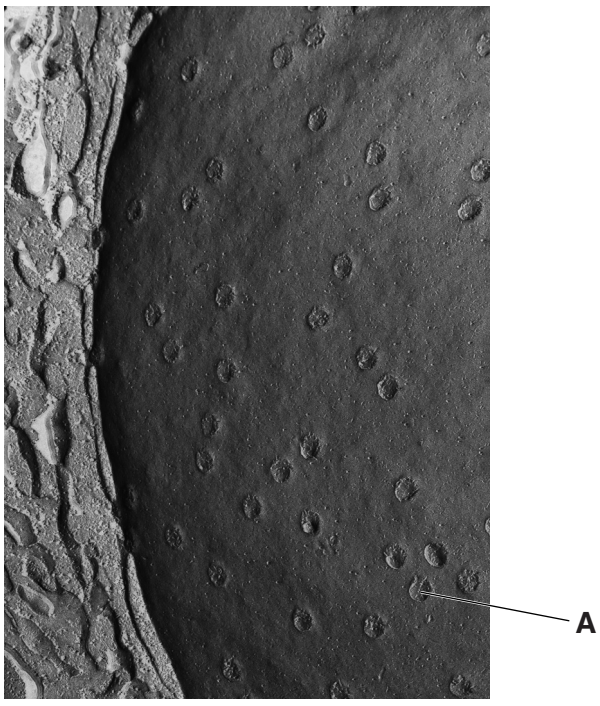
..... **[2]**

(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?

.....

.....

.....

..... **[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.

.....

.....

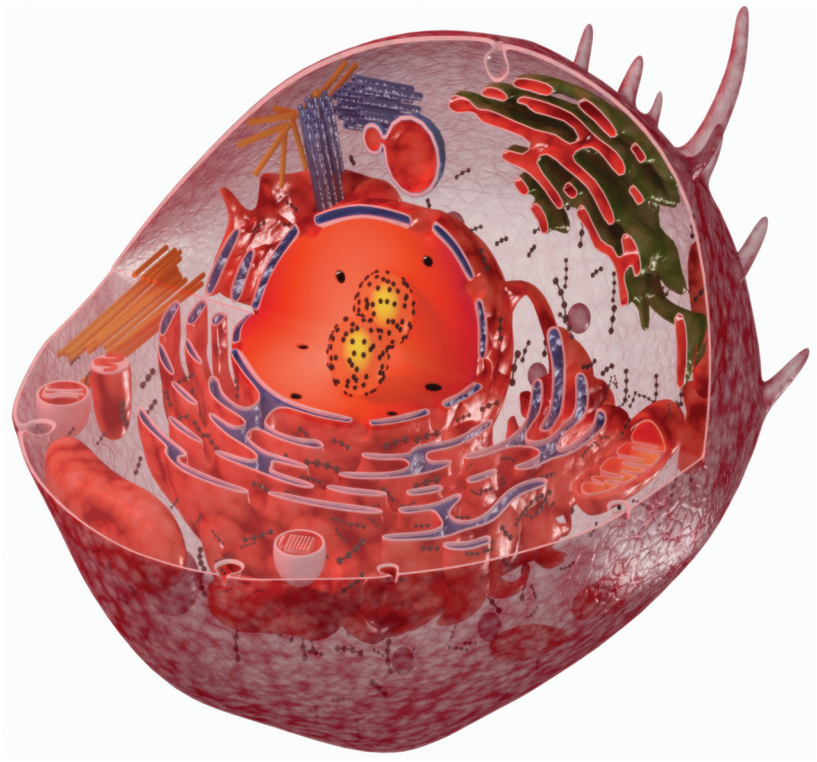
..... **[1]**

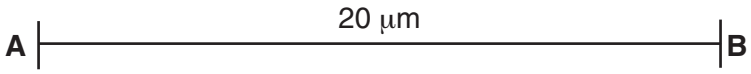
(d) State **two** features of a eukaryotic cell, other than nuclear pores, that would **not** be visible using medium power of a light microscope.

.....

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

[Total: 10]





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(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.

.....

.....

.....

..... **[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]

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

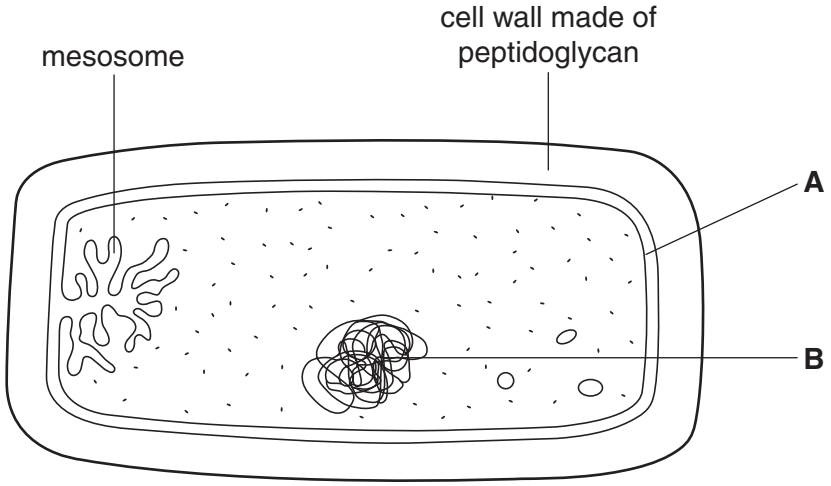


Fig. 1.1

(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.

.....

.....

.....

.....

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

(c) The mammalian gas exchange system contains a variety of types of cells and tissues.

Complete Table 1.1, stating the function of each of the cells and tissues. The first row has been completed for you.

Table 1.1

cell / tissue	function
squamous epithelium	to provide a thin surface for a short diffusion distance
elastic tissue	....
ciliated epithelium	....
goblet cells	....
smooth muscle	....

[4]

[Total: 11]

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

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

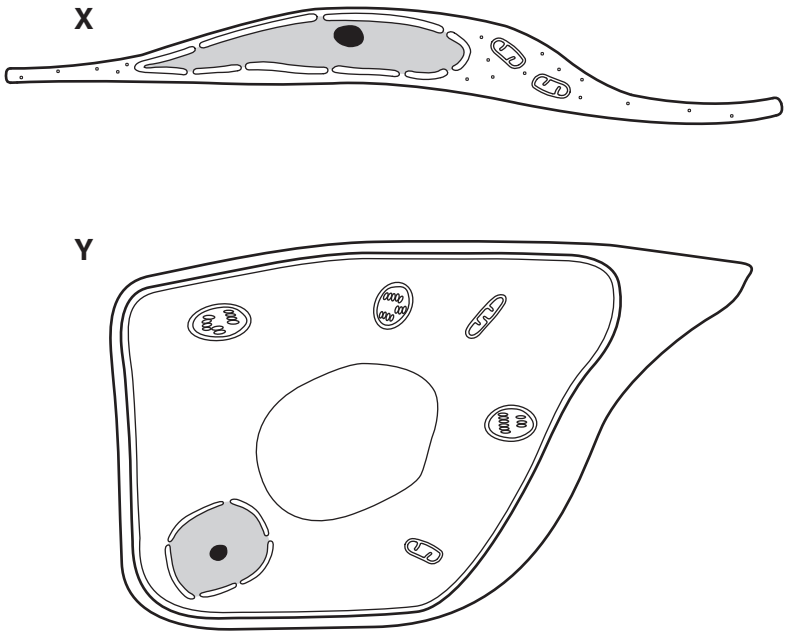


Fig. 4.1

(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]**

(b) Fig. 4.2 shows drawings of the six chromosomes inside an animal cell viewed during late prophase of mitosis.

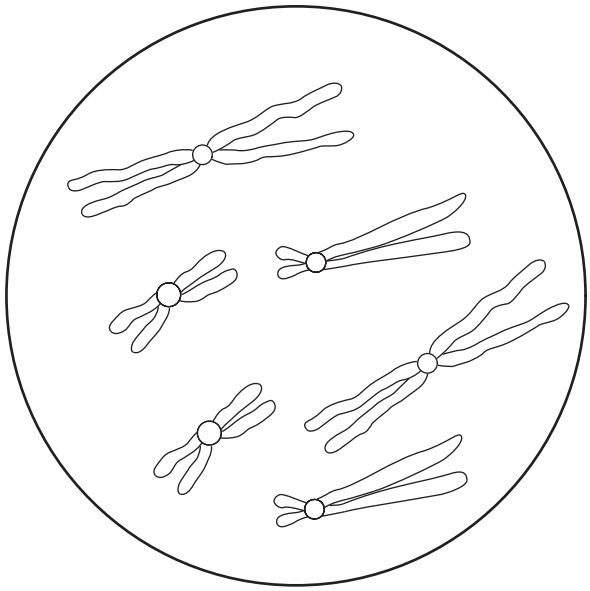
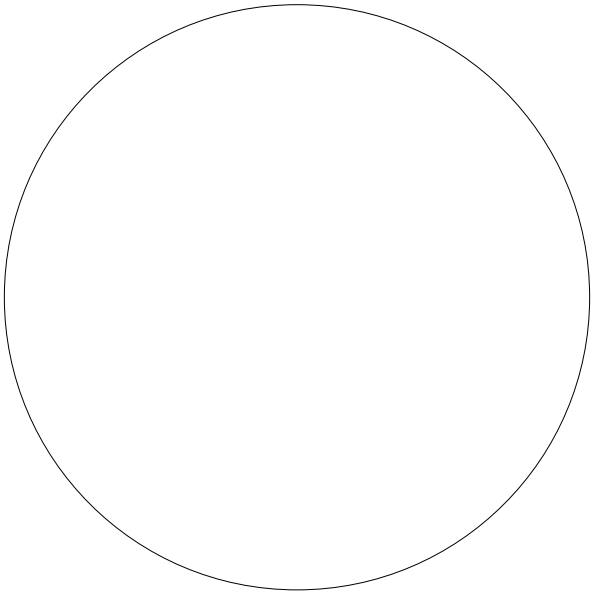


Fig. 4.2

(i) Identify **one pair** of *homologous chromosomes* in Fig. 4.2 by drawing around each chromosome in the pair **on the diagram**. **[1]**

(ii) The nucleus of a sperm cell is produced by **meiosis**.

Draw a diagram in the space below to represent the chromosomes that are present in the nucleus of a sperm cell from **the same animal**.



[2]

[Total: 7]