5. The Mitotic Cell Cycle

5.2 Chromosome Behavior in Mitosis

Paper 2

Question Paper

1 Fig. 4.1 is a scanning electron micrograph showing the tissue that lines the bronchi in the gas exchange system.

Fig. 4.2 is a transmission electron micrograph of a horizontal section made at the position indicated by the two arrows in Fig. 4.1.

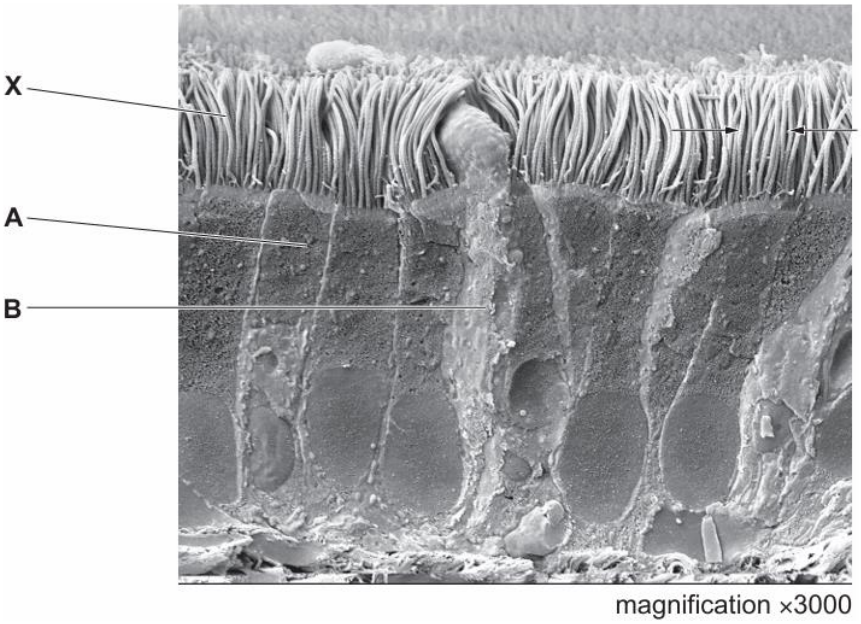


Fig. 4.1

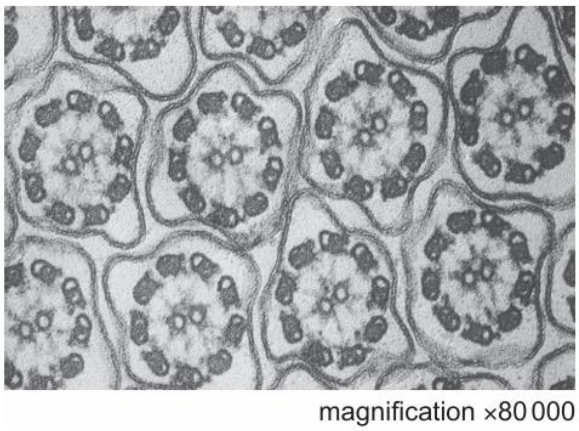


Fig. 4.2

(c) Stem cells are found in the lining of the bronchi.

Describe the function of centrioles **and** explain how they are involved in the cell cycle of a stem cell.

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..... [4]

2 Fig. 6.1 shows a plant cell in a stage of mitosis.

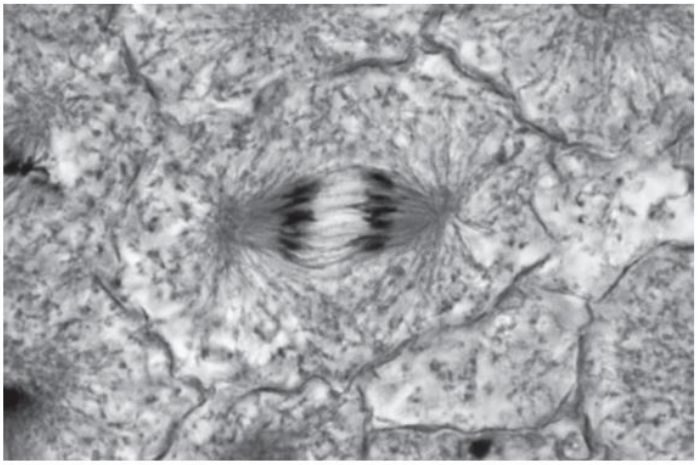


Fig. 6.1

(a) Some of the structures shown in Fig. 6.1 contain DNA.

Use a line labelled **D** on Fig. 6.1 to indicate **one** of these structures. [1]

(b) Name the stage of mitosis shown in Fig. 6.1.

..... [1]

(c) Colchicine is a chemical used by scientists to study mitosis. This chemical inhibits the organisation of the microtubules in prophase of mitosis.

The cell shown in Fig. 6.1 had **not** been treated with colchicine.

Explain the evidence in Fig. 6.1 that shows the cell had **not** been treated with colchicine.

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..... [2]

3 The gene for the enzyme catalase is on chromosome 11 in humans.

(c) Fig. 4.2 is a diagram of chromosome 11 at metaphase of mitosis.

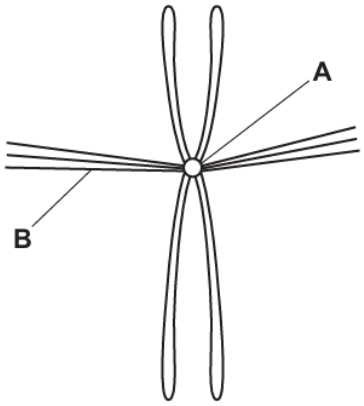


Fig. 4.2

(ii) Complete Fig. 4.3 to show what happens to chromosome 11 in anaphase, so that the daughter nuclei are genetically identical.

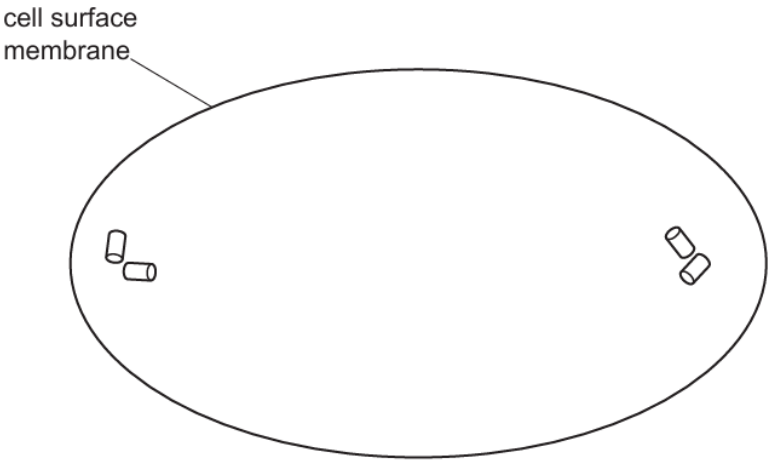


Fig. 4.3 [3]

4 During interphase and mitosis of the cell cycle, the chromosomes within a cell go through a number of changes. Each chromosome is composed of DNA complexed with proteins.

(b) When viewed through a microscope, a chromosome is most clearly visible during the metaphase stage of mitosis.

Complete Fig. 1.1 to produce a labelled diagram of the metaphase stage of mitosis in an **animal** cell with **two** chromosomes.

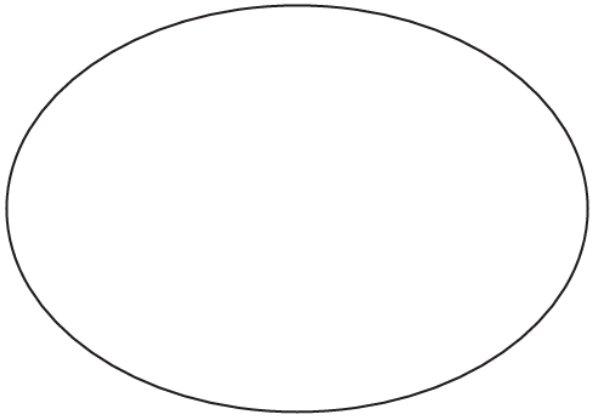


Fig. 1.1

[3]

(c) Outline the changes that occur to the structure and behaviour of a chromosome:

- from the start of the S phase to the end of interphase
- during prophase of mitosis.

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..... [3]

5 **(a)** Fig. 6.1 is a photomicrograph of plant cells in stages of the mitotic cell cycle.

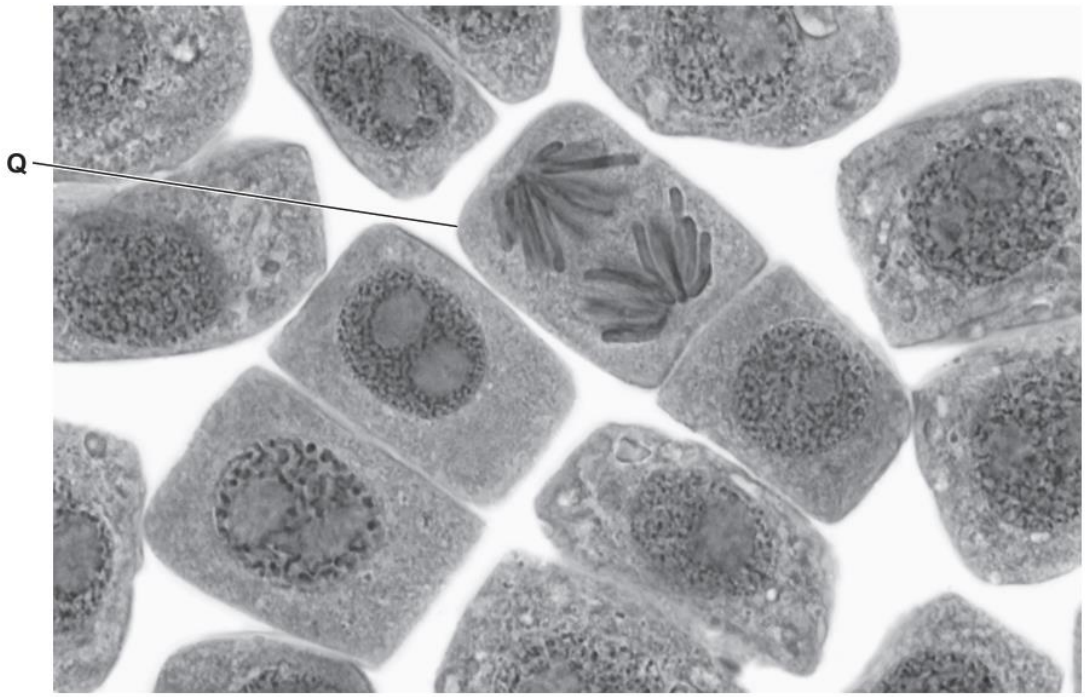


Fig. 6.1

(i) Name the stage of mitosis shown in cell **Q**.

..... [1]

(b) Uncontrolled mitosis can cause cancer in humans.
Paclitaxel is a drug used in the treatment of some forms of cancer.

Researchers investigated the effect of Paclitaxel on the mitotic cell cycle of cancer cells.

- The cancer cells were grown for two days and then divided into groups.
- Each group was treated with a different concentration of Paclitaxel.

After 28 hours (one cell cycle):

- the percentage of cells in stages of mitosis was calculated
- the ratio of the number of cells in anaphase to the number of cells in metaphase was determined.

The results of the investigation are shown in Fig. 6.2.

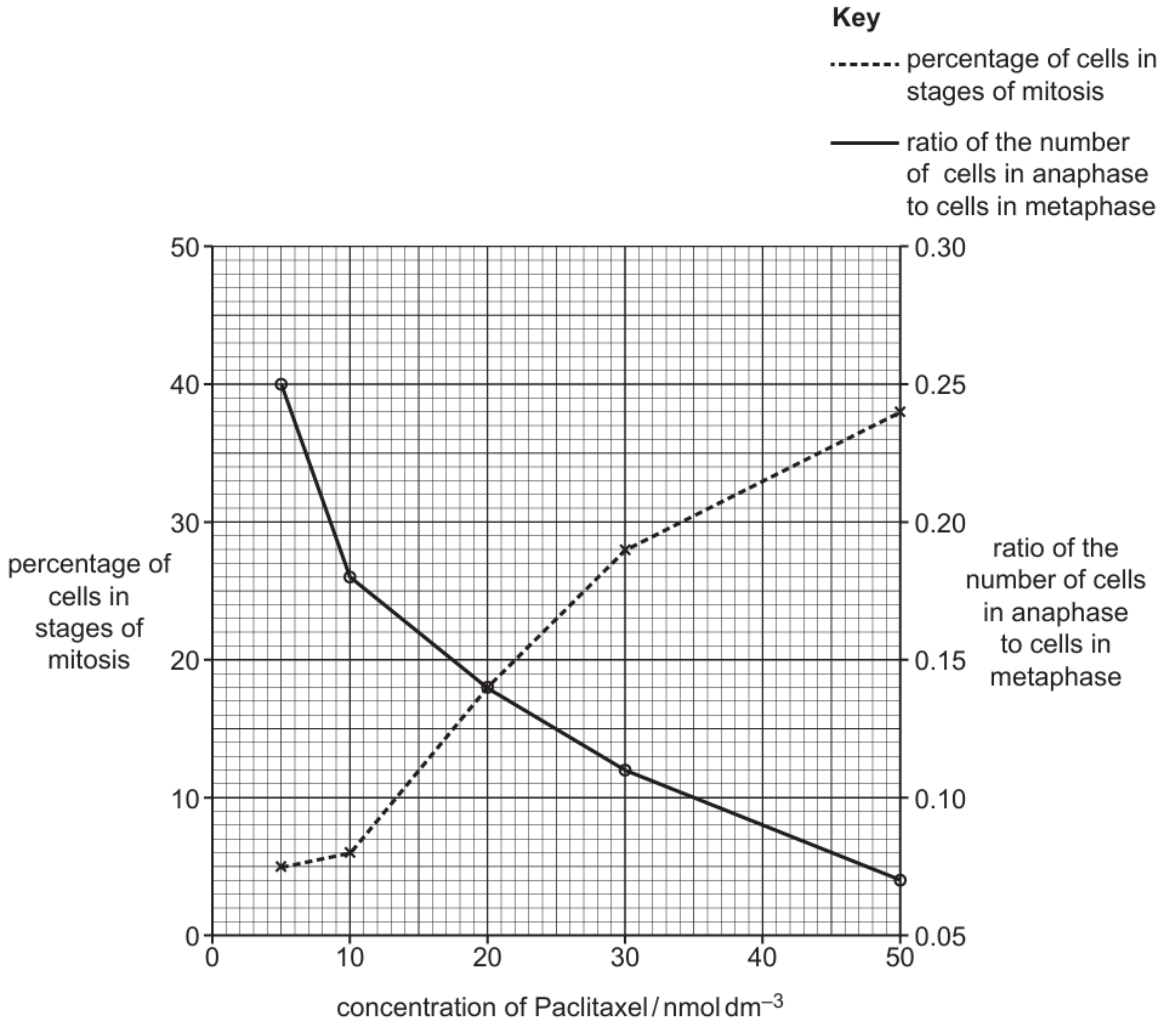


Fig. 6.2

With reference to Fig. 6.2, describe the results and suggest an explanation for the effect of Paclitaxel on the mitotic cell cycle.

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6 **(a)** Fig. 1.1 is a photomicrograph of a region of eukaryotic tissue. Some of the cells are in stages of mitosis.

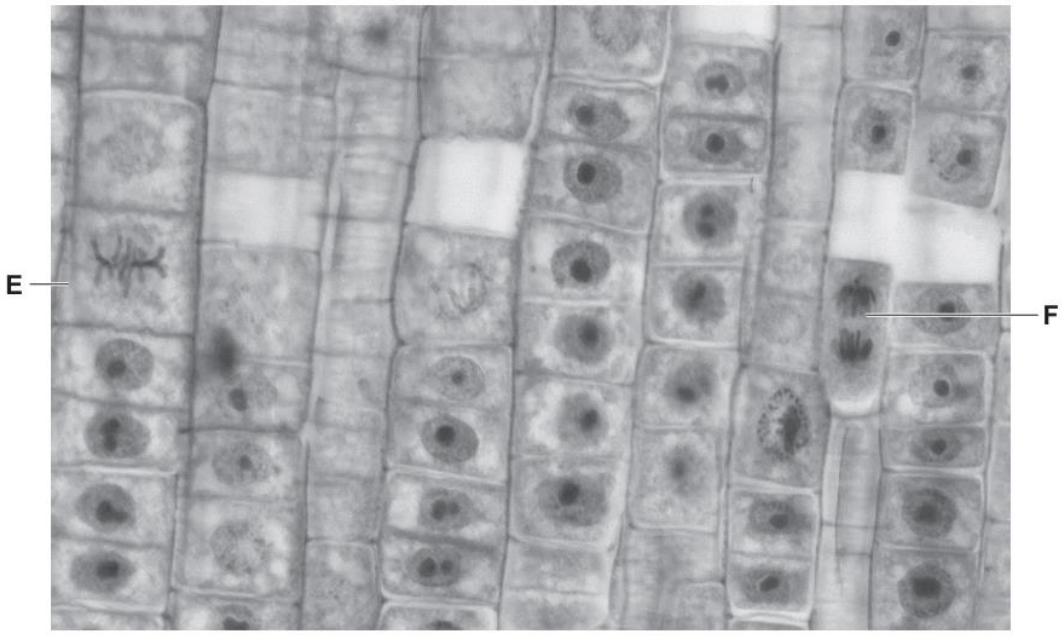


Fig. 1.1

(i) Identify which stage of mitosis is shown in cell **E** and in cell **F** in Fig. 1.1.

E .....

F ..... [2]

(ii) Microtubules are present within the cells that are in stages of mitosis, but these are not visible in Fig. 1.1.

State the function of microtubules in mitosis.

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..... [1]

7 There are two types of cell, prokaryotic and eukaryotic. Bacterial cells are prokaryotic and plant cells are eukaryotic.

(d) Fig. 1.2 shows plant cells in a root tip where cell division by mitosis is taking place.

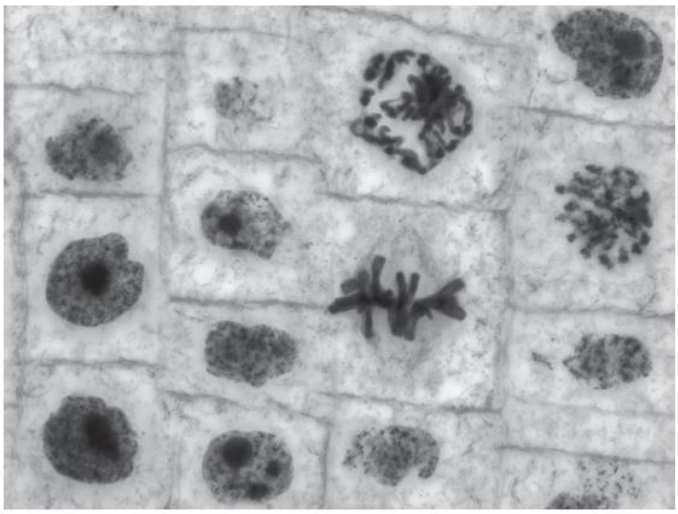


Fig. 1.2

Identify **two** cells in Fig. 1.2 that are in different stages of mitosis.

Draw a label line to each cell and add the name of the stage of **mitosis** that is shown by the cell. [2]

8 **(a)** Fig. 4.1 is a drawing made by a student of a plant cell, showing one of the stages of mitosis.



Fig. 4.1

(i) Describe the role of the spindle during this stage of mitosis.

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..... [2]

9 Fig. 2.1 shows some stages of the cell cycle in the meristematic tissue in the root tip of a plant. Three of these stages, **P**, **Q** and **R**, are identified in Table 2.1.

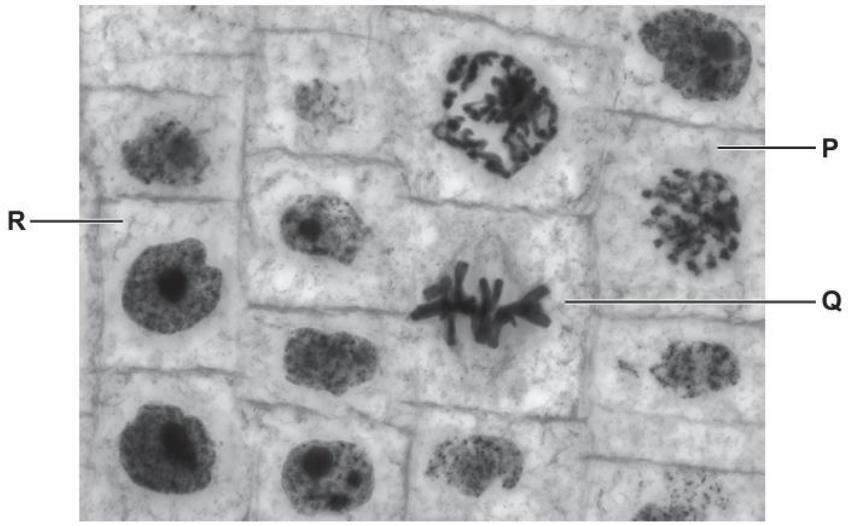


Fig. 2.1

(a) Complete Table 2.1 by stating **one** feature, **visible in Fig. 2.1**, that is used to identify each stage.

Table 2.1

cell	stage of cell cycle	reason
P	prophase of mitosis	
Q	metaphase of mitosis	
R	interphase	

[3]

(b) (iii) Describe how the spindle is involved during the process of mitosis.

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10 **(a)** Fig. 1.1 is a diagram of a human chromosome at a stage in mitosis.

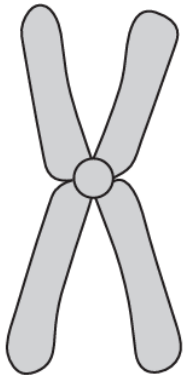


Fig. 1.1

(ii) State **one** stage during mitosis when the chromosome would appear as shown in Fig. 1.1.

..... [1]

11 **(c)** Fig. 6.1 is a scanning electron micrograph of a lung cancer cell in a stage of the cell cycle.

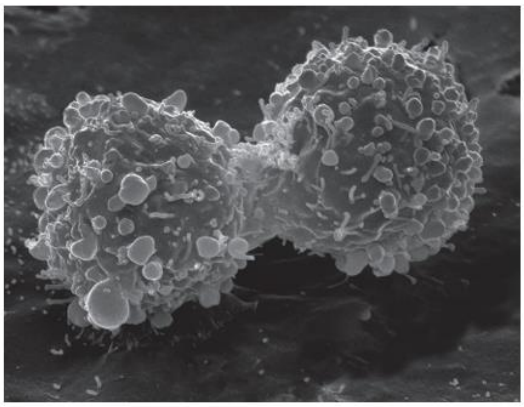


Fig. 6.1

(i) Name the stage of the cell cycle occurring in Fig. 6.1.

..... [1]

12 Fig. 4.1 is a photomicrograph showing some cells in interphase and some cells in stages of mitosis.

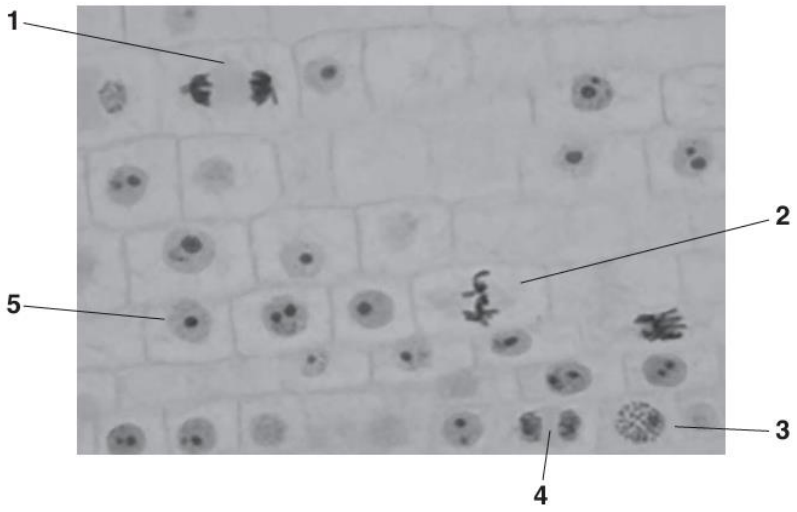


Fig. 4.1

(a) Choose from the cells labelled **1** to **5** in Fig. 4.1 to identify the cell in which:

- the nuclear envelope is reassembling .....
- the spindle begins to form .....
- there is a high rate of transcription and translation .....

[3]

(b) Cell **2** is in a stage of mitosis that occurs before the stage of mitosis shown in cell **1**.

Outline the changes that would occur from the stage of mitosis shown in cell **2** to the stage shown in cell **1**.

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.....[2]