The Mitotic Cell Cycle

(Past Year Topical Questions 2010-2015)

May/June 2011 (21)

1 Fig. 1.1 is an electron micrograph of cells from the ciliated epithelium of the trachea.

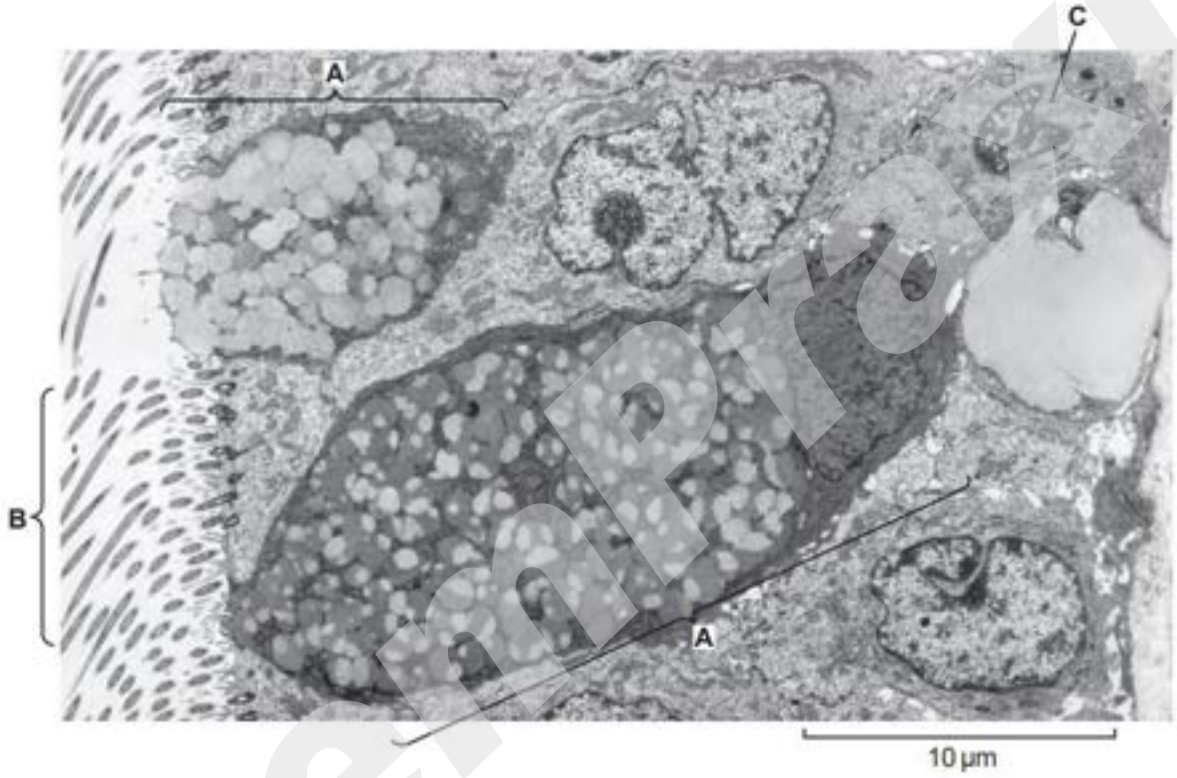


Fig. 1.1

(c) Cells, such as **C**, at the base of the epithelium of the trachea divide by mitosis.

Describe the changes that occur within the cell between the beginning of prophase and the end of metaphase.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....[5]

May/June 2011 (22)

1 Fig. 1.1 is a photomicrograph of a root tip of onion, *Allium cepa*, showing cells in interphase and in stages of mitosis.

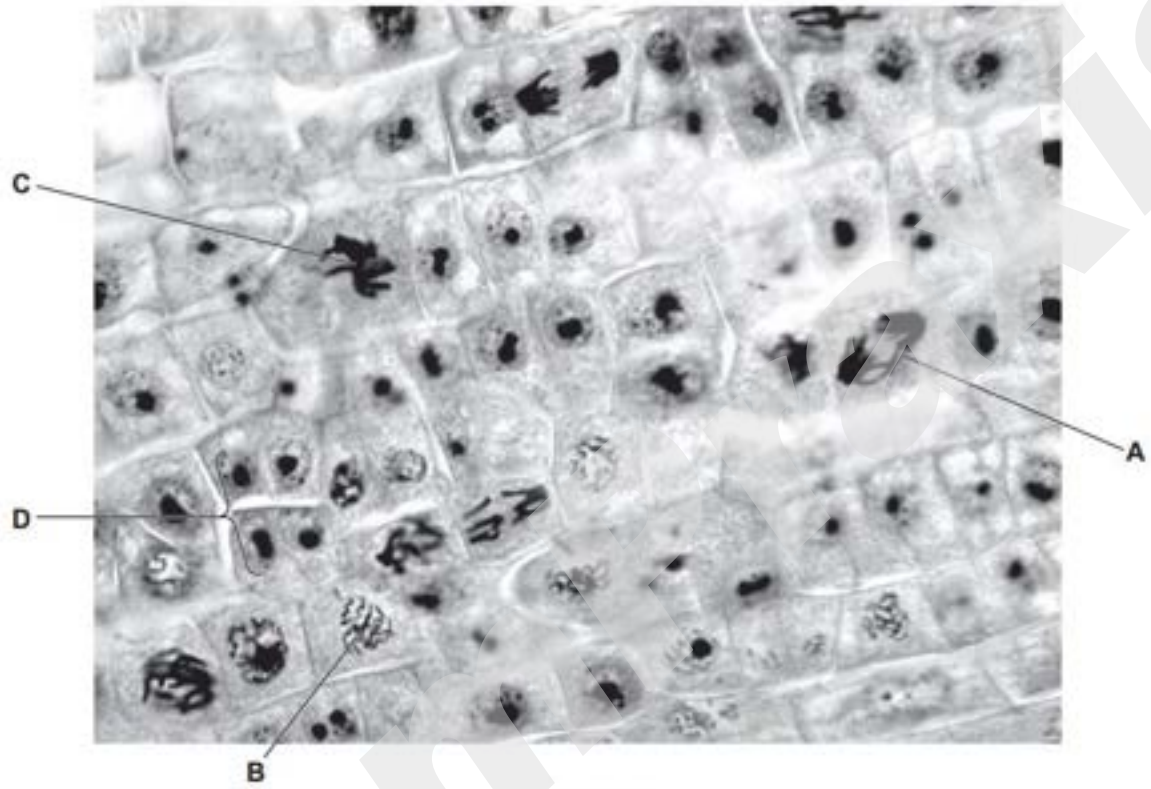


Fig. 1.1

(a) Name the stages of mitosis shown in cells **A**, **B** and **C**.

A .....

B .....

C .....[3]

(b) Suggest why the cells labelled **D** are smaller than most of the other cells in Fig. 1.1.

.....

.....

.....[1]

(c) Interphase is often described as a 'resting stage'.

Explain why the term 'resting stage' is not an appropriate description for cells in interphase.

.....

.....

.....[2]

May/June 2011 (23)

1 Fig. 1.1 shows a stage in the mitotic cell cycle in an animal cell.

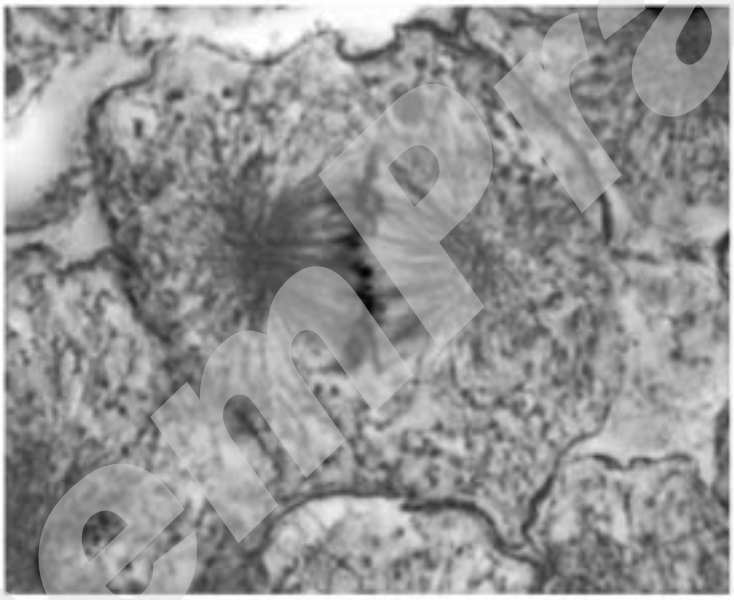


Fig. 1.1

(a) (i) Name the stage of mitosis shown in Fig. 1.1.

.....[1]

(ii) State three features which are characteristic of the stage of mitosis shown in Fig. 1.1.

1. .....

.....

2. .....

.....

3. .....

..... [3]

(b) Explain the importance of mitosis in organisms.

.....

.....

.....

.....

.....

..... [3]

(c) In many multicellular organisms, such as mammals, the time taken for the mitotic cell cycle varies considerably between different tissues, but is very carefully controlled in each cell.

Suggest the importance of this control in mammals.

.....

.....

.....

.....

.....

..... [2]

Oct/Nov 2011 (21)

4 **(a)** **(i)** Name two factors that increase the chances that cancer will develop.

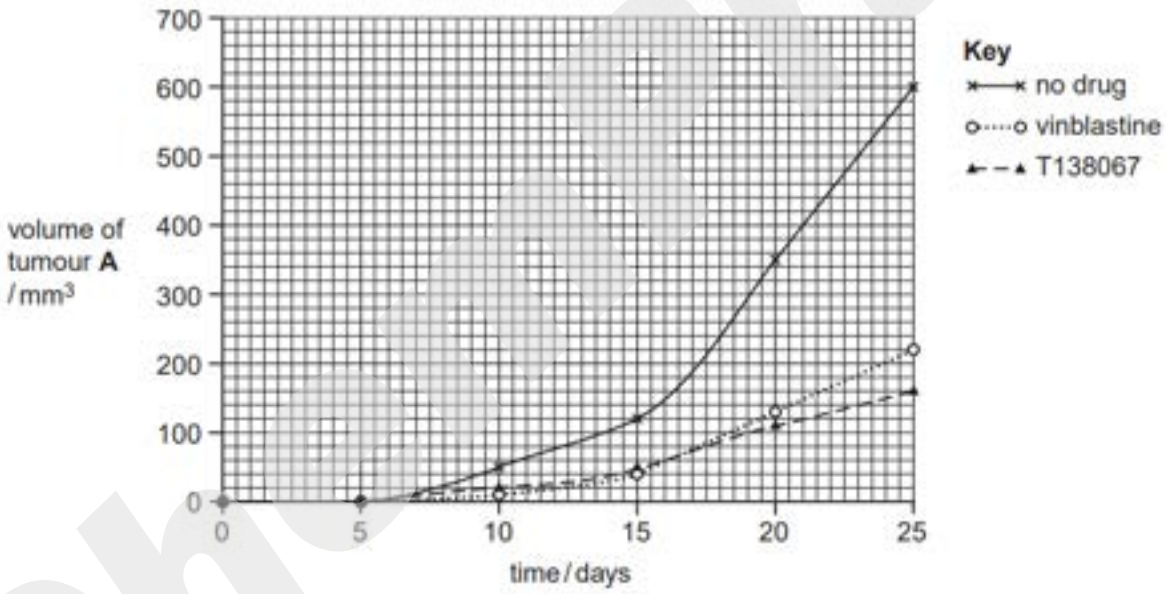
1. .....

2. .....[2]

The effectiveness of anti-cancer drugs may be determined by growing different tumours in culture.

The effectiveness of two drugs on two human tumours (**A** and **B**) from different tissues was assessed. The two drugs, T138067 and vinblastine, were added to the tumours in culture on days 5, 12 and 19. The volumes of the tumours were compared with the volumes of tumours that were not treated with any drugs.

The results are shown in Fig. 4.1.



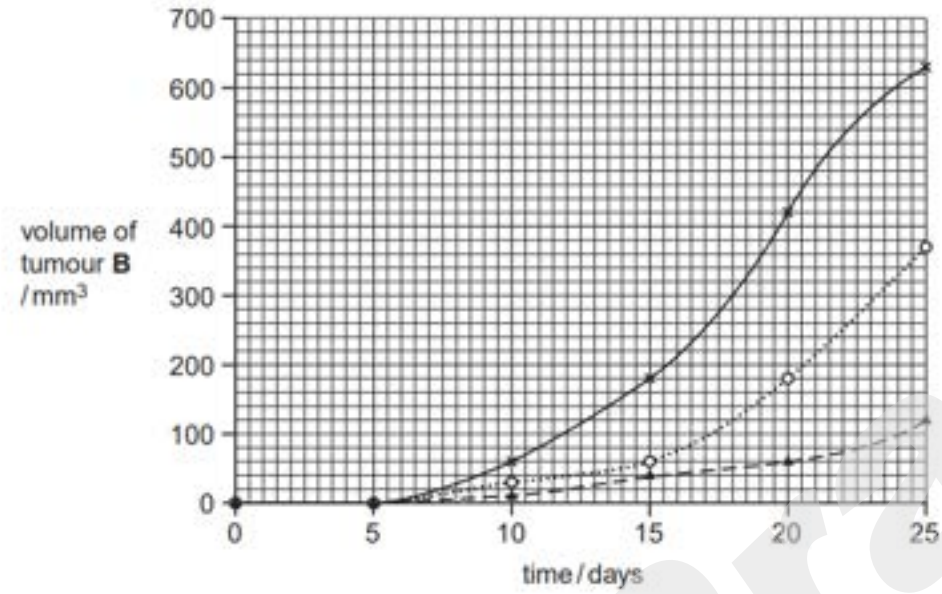


Fig. 4.1

(b) Use the data in Fig. 4.1 to compare the effectiveness of the two drugs used to treat the tumours.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

(c) Vinblastine disrupts the formation of the spindle apparatus during mitosis.

Explain how vinblastine has its effect as an anti-cancer drug.

.....

.....

.....

.....

.....

.....[3]

May/June 2012 (22)/Q2

(ii) B-lymphocytes have centrioles and a spindle that can be observed during mitosis.

Describe and explain how the behaviour of the centrioles and spindle of a cell dividing by mitosis is associated with the behaviour of the chromosomes.

You may use the space below for labelled diagrams.

.....

.....

.....

.....

..... [4]

Oct/Nov 2012 (21)

3 Bone marrow contains stem cells that divide by mitosis to form blood cells. Each time a stem cell divides it forms a replacement stem cell and a cell that develops into a blood cell.

Fig. 3.1 shows changes in the mass of DNA in a human stem cell from the bone marrow during three cell cycles.

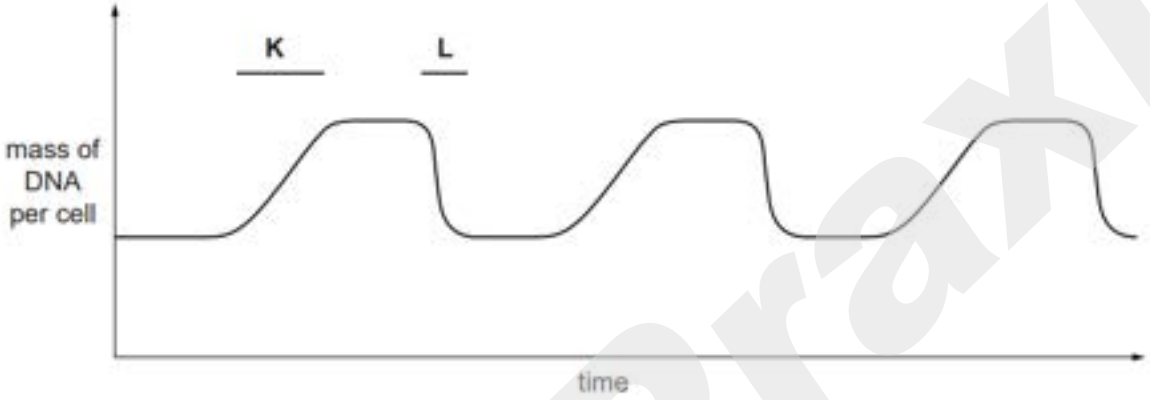


Fig. 3.1

(a) With reference to Fig. 3.1, state:

(i) what happens to bring about the changes in the mass of DNA per cell at **K** and at **L**

K .....

.....

L .....

..... [2]

(ii) how many blood cells are formed from the stem cell in the time shown

..... [1]

(iii) what happens to the number of chromosomes in the stem cell.

..... [1]

May/June 2013 (21)

6 **(a)** Explain how uncontrolled cell division can result in cancer.

.....

.....

.....

.....

.....

.....

..... [3]

May/June 2013 (23)

5 **(a)** Explain the importance of mitosis in multicellular organisms.

.....

.....

.....

.....

.....

..... [3]

A protein, mitosis-promoting factor (MPF), has been identified in cells. MPF is a globular protein made from two polypeptide chains.

The presence of MPF is known to cause prophase to start.

(c) Describe the changes that occur during prophase in an animal cell.

.....

.....

.....

.....

.....

.....

.....

..... [4]

(d) MPF normally begins to break down and stops functioning during anaphase.

Suggest the possible consequences of MPF not breaking down.

.....

.....

.....

.....

.....

.....

..... [3]

Oct/Nov 2013 (21)

1 Fig. 1.1 shows a cell of a female fruit fly, *Drosophila melanogaster*, during a stage of mitosis.

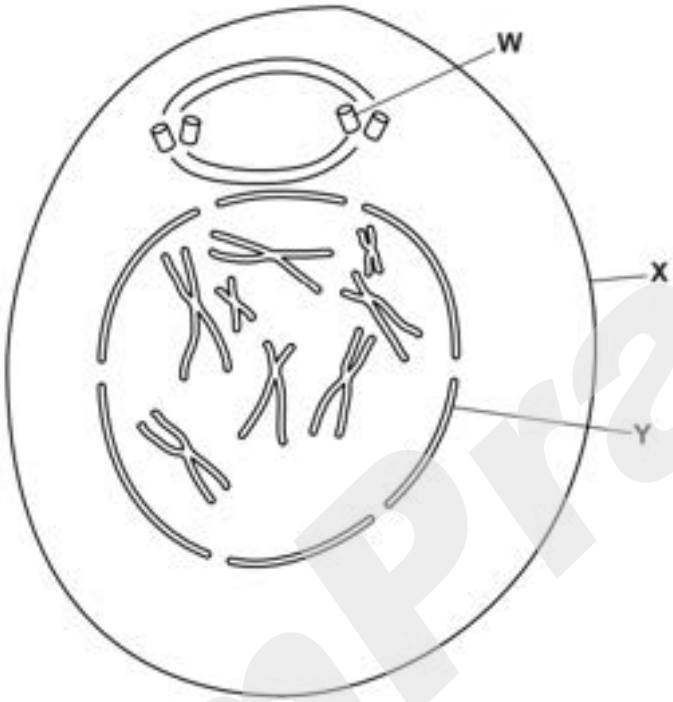


Fig. 1.1

(a) (i) Name the stage of mitosis shown in Fig. 1.1.

.....[1]

(ii) Shade a pair of homologous chromosomes. [1]

(iii) Name the structure labelled **W** and state its function.

.....

.....

.....[2]

(b) State what happens to structure **X** and to structure **Y** between the stage shown in Fig. 1.1 and the end of cell division.

.....

.....

.....

.....

.....

.....

.....

.....[3]

Oct/Nov 2013 (22)/Q1

(d) The inner lining of arteries and veins is composed of a layer of epithelial cells supported by a layer of elastic and connective tissue. The epithelial cells are capable of cell division by mitosis.

(i) State the role of mitosis in cell division of epithelial cells.

.....

.....

.....

.....[2]

(e) Fig. 1.2 is a diagram of a cell in late prophase of mitosis.

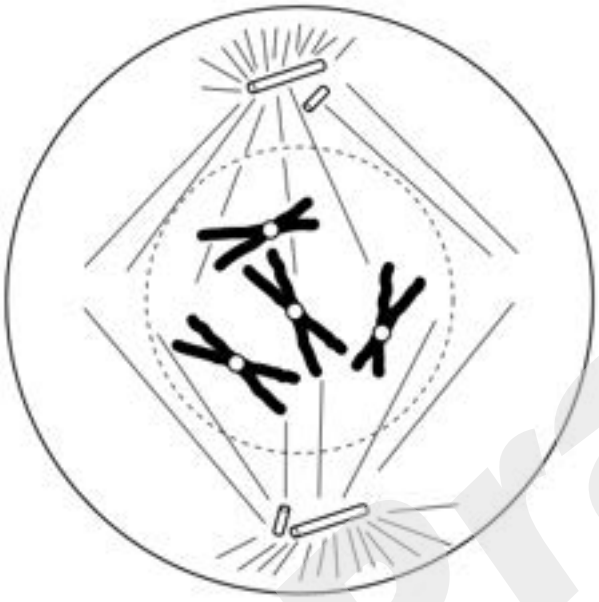


Fig. 1.2

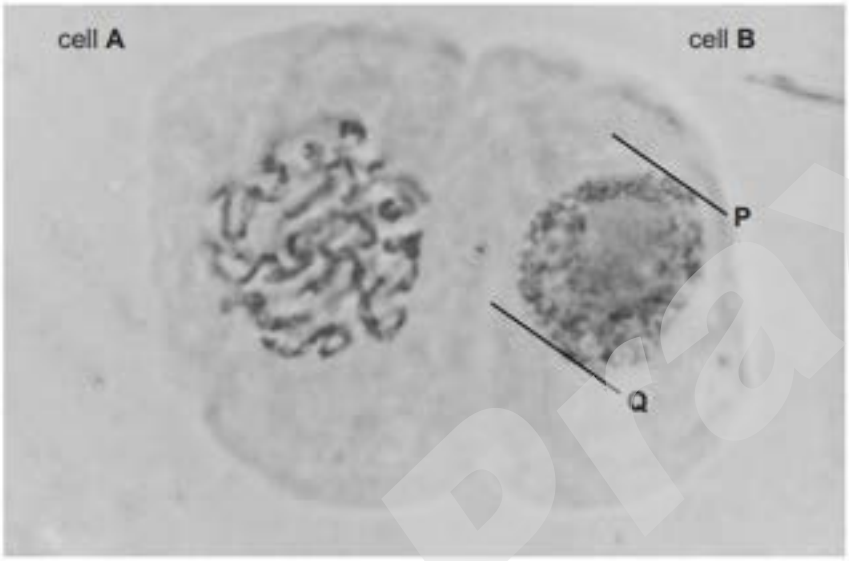
Complete Fig. 1.3 to show the **same** cell in the **anaphase** stage of mitosis.

Fig. 1.3

[2]

Oct/Nov 2013 (23)

3 Fig. 3.1 is a photomicrograph of two animal cells, **A** and **B**, at different stages of the mitotic cell cycle.



magnification × 5000

Fig. 3.1

(a) (i) For each cell, state the name of the stage of the cell cycle shown in Fig. 3.1.

cell **A** .....

cell **B** .....

[2]

(ii) Describe the events that occur during the stage of the cell cycle named for cell **A** in **(a)(i)**.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... [4]

Oct/Nov 2014 (21)

4 (a) A student cut thin sections of a root tip of *Allium cepa* and stained them to show chromosomes. A photomicrograph of part of one of these sections is shown in Fig. 4.1.

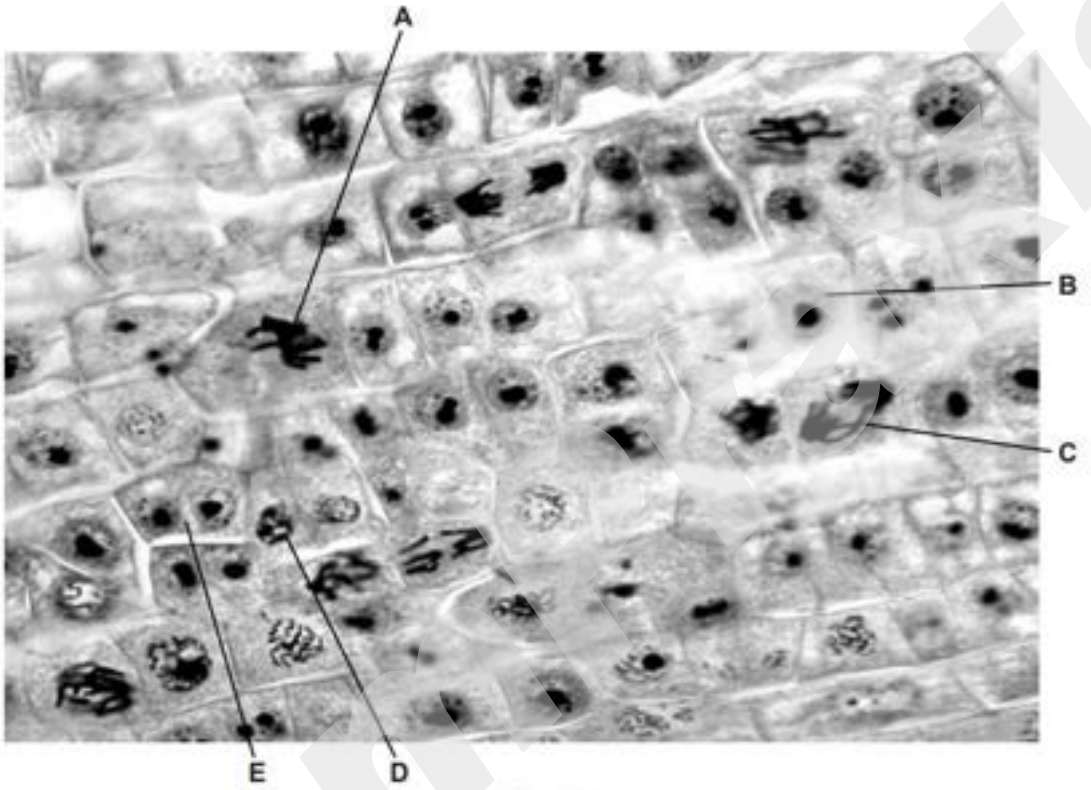


Fig. 4.1

Table 4.1 shows the behaviour of chromosomes and the changes that occur to the nuclear envelope during a mitotic cell cycle in the root tip of *A. cepa*.

Complete Table 4.1.

Table 4.1

name of stage	cell in Fig. 4.1	behaviour of chromosomes	nuclear envelope
	B	chromosomes uncoiled, may be replicating	intact
prophase			intact, but then breaks down
metaphase			not present
anaphase		chromosomes / chromatids, moving to opposite poles	
telophase		chromosomes uncoiling	

[5]

(c) State two processes, **other than growth**, in which mitosis is involved.

1. .....

2. .....

[2]

Oct/Nov 2014 (23)

1 Fig. 1.1 is a photomicrograph of plant root cells near the growing tip. Some of the cells are undergoing mitosis.

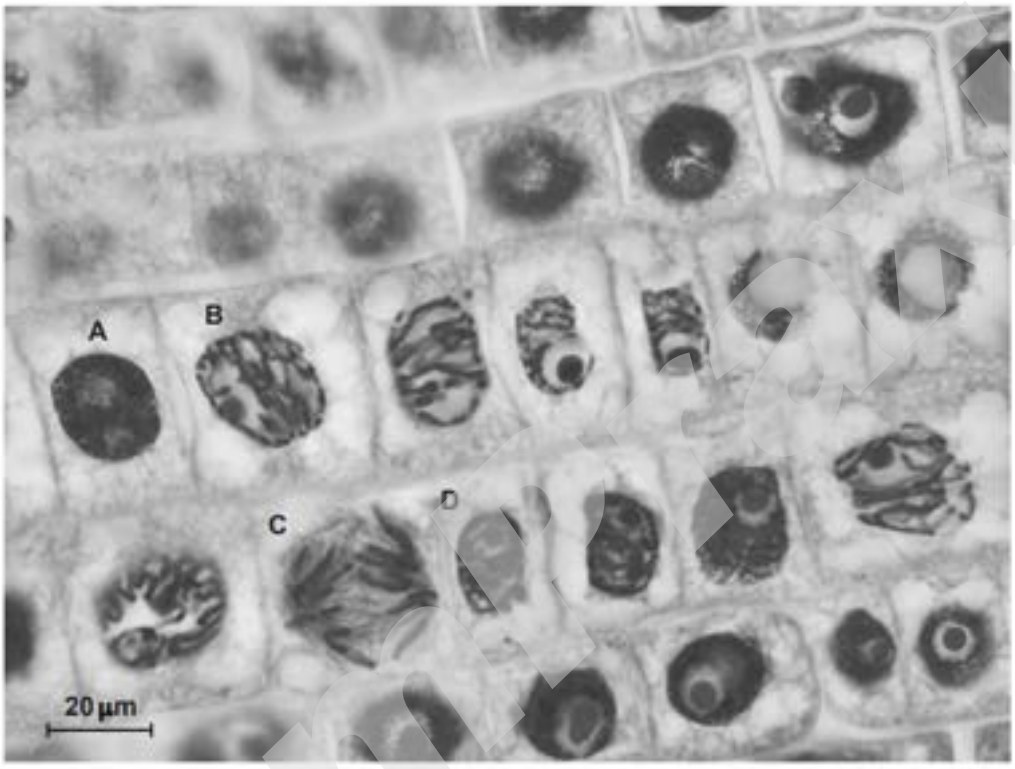


Fig. 1.1

(a) State **one** feature, visible in Fig. 1.1, which indicates that the section is taken from plant tissue and not animal tissue.

.....

.....[1]

(b) State the letter, **A** to **D**, of the cell in Fig. 1.1 which is in:

(i) prophase .....

(ii) anaphase. ..... [2]

(c) Describe two events occurring in cell **B**.

1. .....

.....

2. .....

..... [2]

(d) **(i)** Describe the role of mitosis in a growing plant root tip.

.....

.....

.....

.....

..... [2]

May/June 2015 (21)

1 A student investigated growth in the roots of broad bean, *Vicia faba*. The student cut sections of the root tip of this plant and viewed them with a light microscope.

Fig. 1.1 is a photomicrograph of one of the sections. The cell labelled **D** is in interphase.

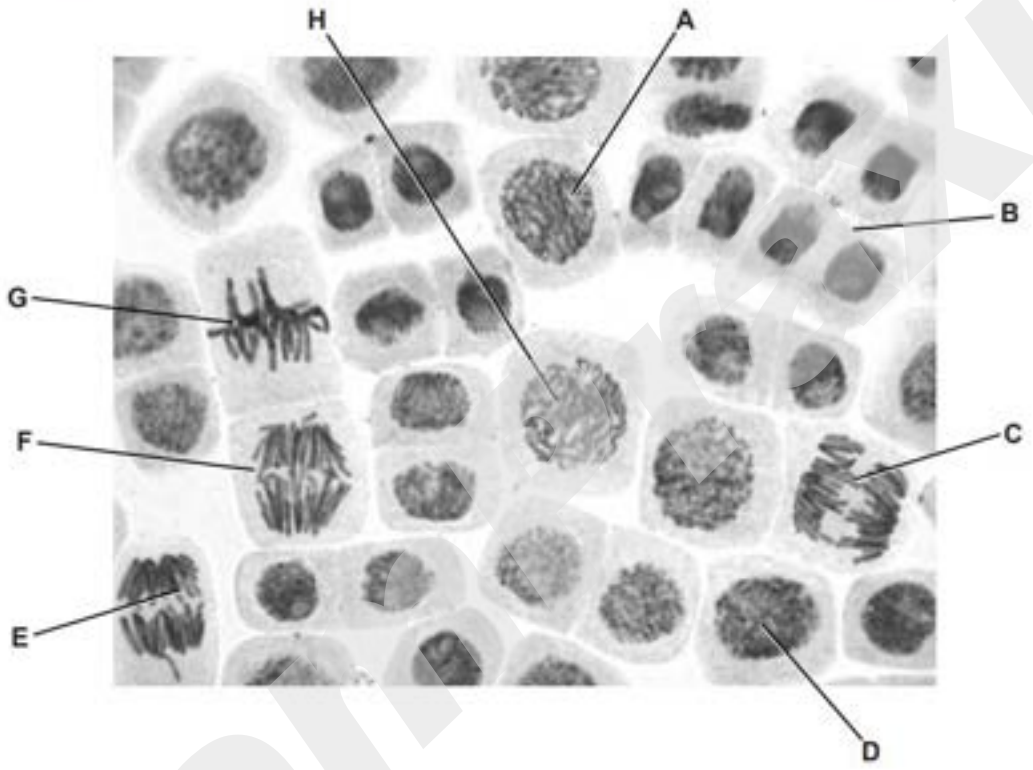


Fig. 1.1

(a) Complete the table below by:

- naming the stages of mitosis in the correct sequence following interphase
- identifying **one** example from the cells labelled **A** to **H** that is in each stage of mitosis that you have named.

stage of mitosis	label from Fig. 1.1

[5]

(b) In animal cells, centrioles are responsible for assembling microtubules to make the spindle at the beginning of mitosis.

Describe the role of the spindle during mitosis.

.....

.....

.....

.....

.....

.....[2]

(c) State two roles of mitosis in plants and animals **other than growth**.

1 .....

2 .....[2]

Oct/Nov 2015 (21)

3 Fig. 3.1 is a light micrograph of cells in the root tip of the garlic plant *Allium sativum*. It has a diploid number (2n) of 16.

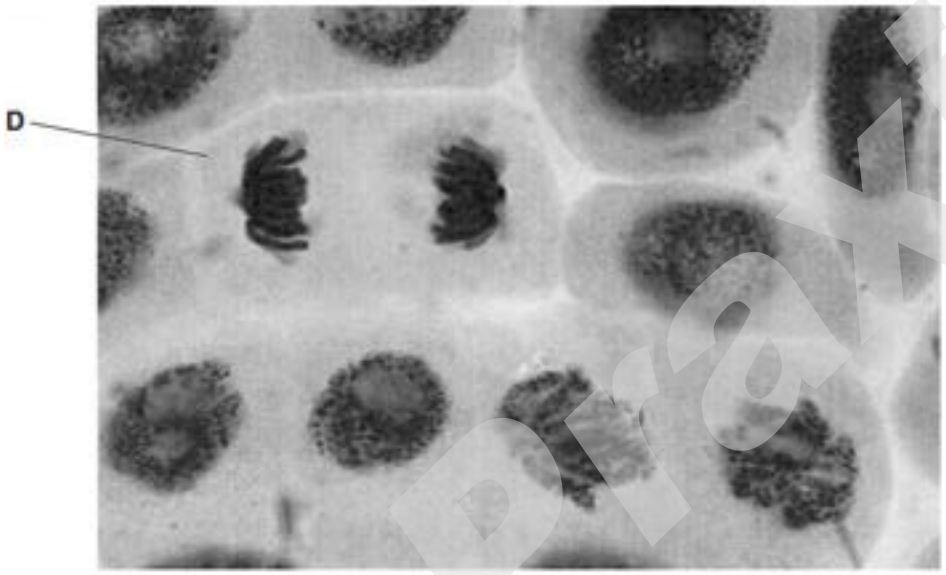


Fig. 3.1

(a) Name the stage of mitosis shown in cell D.

..... [1]

(b) Explain why mitosis occurs in a plant such as *A. sativum*.

.....

.....

.....

.....

..... [2]

Oct/Nov 2015 (22)

3 The photomicrographs in Fig. 3.1 show stages of the mitotic cell cycle occurring in the root tip of the onion, *Allium sp.* They are all of the same magnification. Stages **A** to **C** are in the correct sequence and stages **K** to **N** are **not** in the correct sequence.

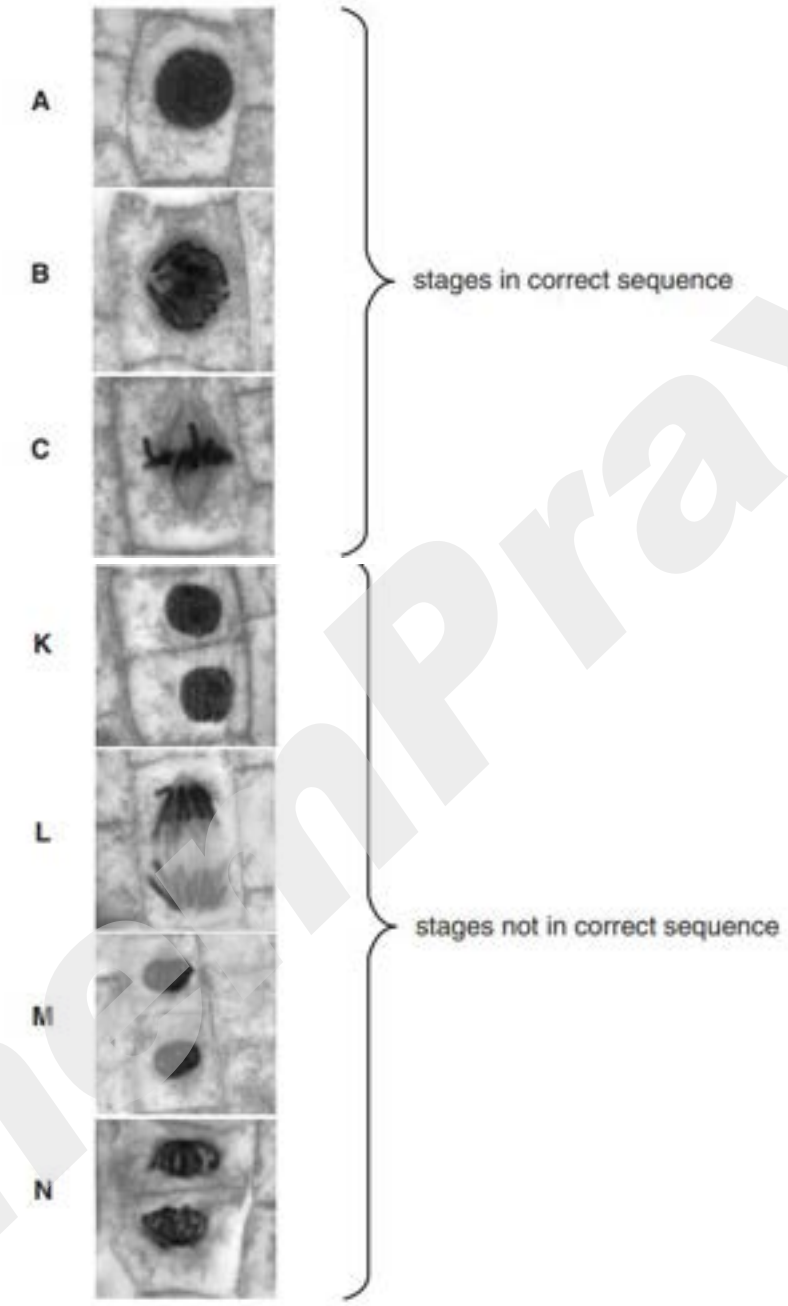


Fig. 3.1

(a) Name stages **A** and **C**.

A .....

C ..... [1]

(b) Put stages **K** to **N** in the correct sequence, starting with the stage that immediately follows stage **C**.

C ⟶ ..... ⟶ ..... ⟶ ..... ⟶ ..... [1]

(c) Explain how the behaviour of the chromosomes and spindle during stage **L** in Fig. 3.1 ensures that the two daughter cells will be genetically identical.

.....

.....

.....

.....

.....

.....

..... [3]