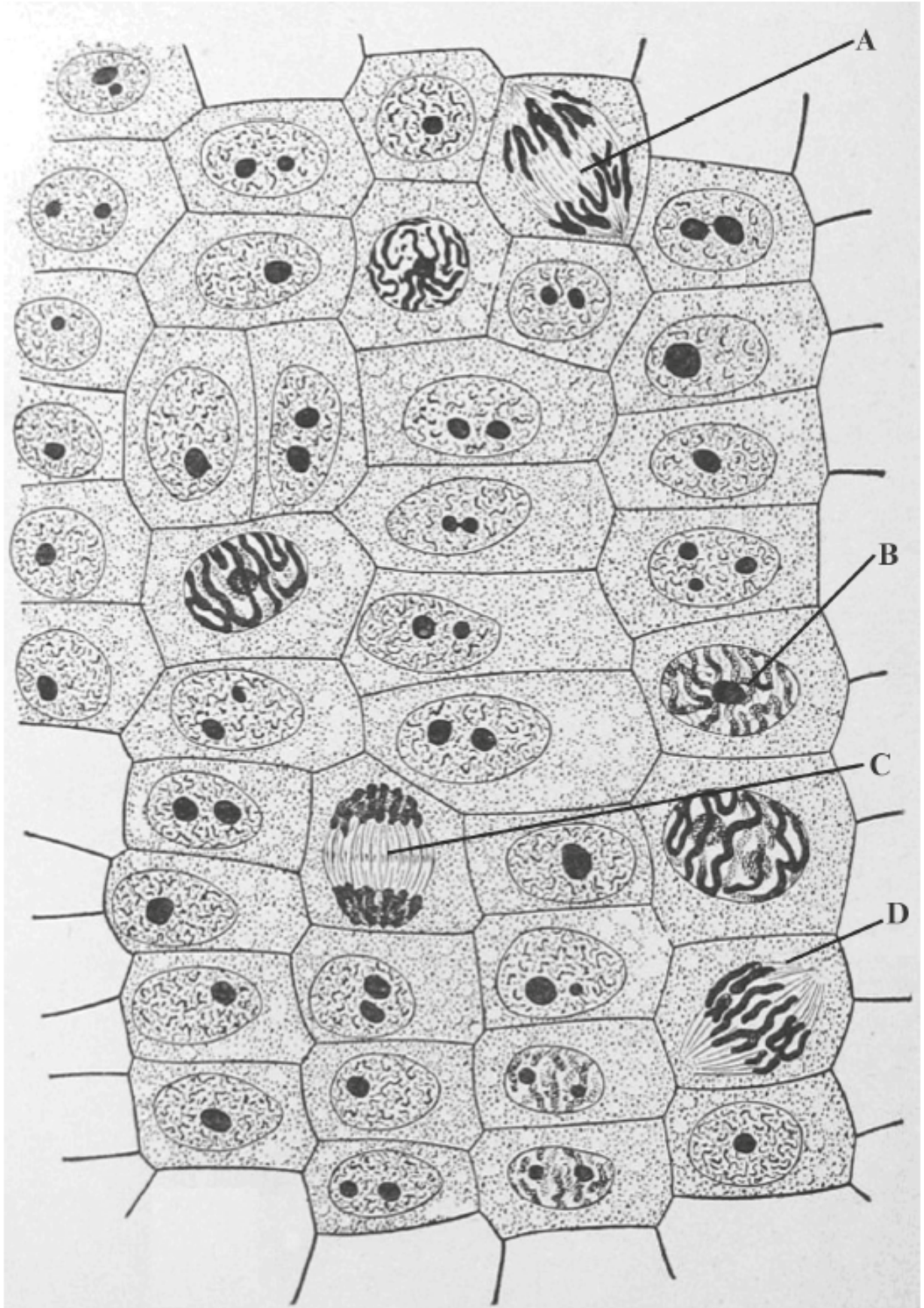


WJEC (Wales) A-level Biology
Topic 1.6: Cell Division
Questions by Topic

1. The drawing below is taken from plant tissue which shows cells undergoing mitosis.



(a) What plant tissue could be observed to produce this drawing?

[1]

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(b) Identify from the diagram opposite the stages of mitosis labelled **A** to **D**.

A

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B

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C

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D

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(c) One stage of the **cell cycle** shown on the diagram is present in greater numbers than the others. Name this stage and explain this observation.

[2]

Stage:

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Explanation:

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(d) How would cells produced by meiosis differ from those produced by mitosis?

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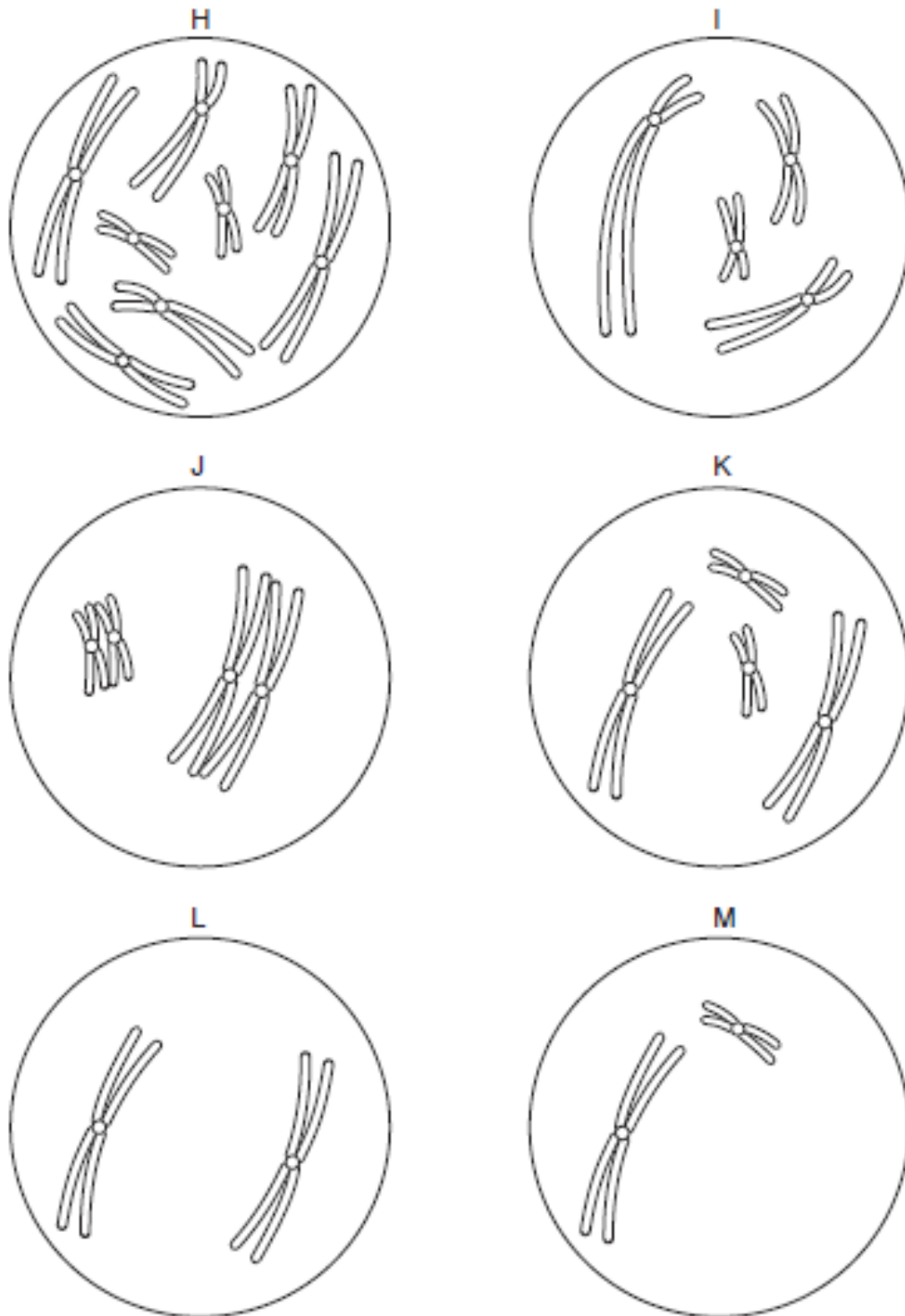
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Total

2.

Spider mites are small invertebrates which are related to spiders and scorpions. One species, *Eutetranychus africanus*, which is native to the island of Mauritius, has very few chromosomes, $2n = 4$.

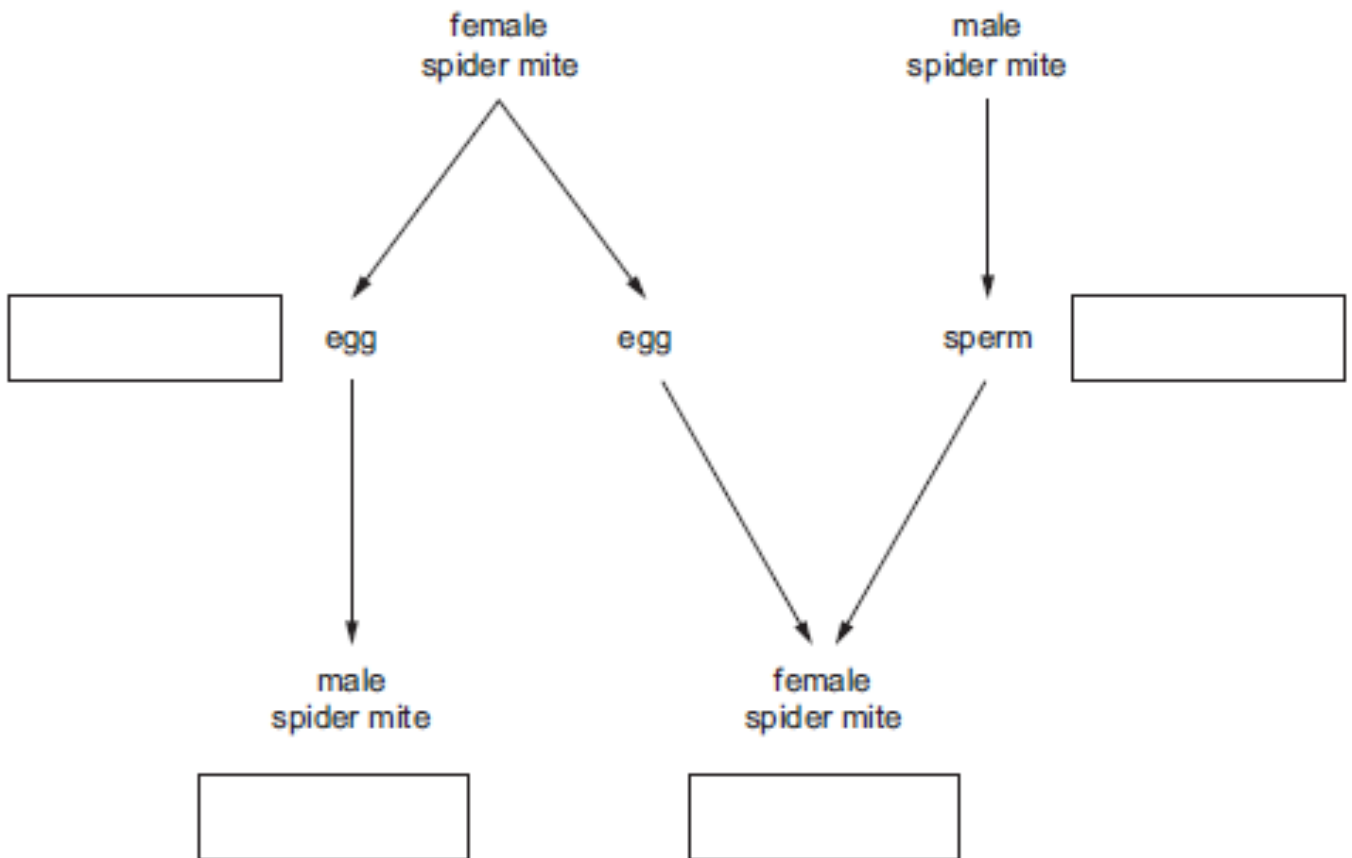
The diagrams below show the chromosomes in some cells undergoing mitosis or meiosis.



(a) Identify the cells that belong to this species of spider mite.

[2]

- (b) The diagram below shows the individuals that make up a colony of spider mites. Female spider mites are produced when a male sperm fertilises a female's egg. Male spider mites develop from an unfertilised female egg.



- (i) Complete the diagram to state which stages are haploid or diploid. [2]
- (ii) What conclusions can be made about the formation of male and female gametes in spider mites? [2]

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- (c) (i) A sample of tissue from the leg muscle of a young spider mite was analysed. The mass of DNA in some of the cells was 6.8 arbitrary units (au), whilst in other cells it was 3.4 au. Suggest explanations for this difference using your knowledge of the cell cycle. [3]

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- (ii) The table below shows the percentage of cells, with either 3.4 au or 6.8 au of DNA, in the leg muscle of a young spider mite and an older spider mite.

Mass of DNA in cell /au	Percentage of cells	
	Young spider mite	Older spider mite
6.8	20	5
3.4	80	95

What conclusions can be drawn from the data regarding the significance of mitosis in these spider mites? [2]

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3.

(a) Meiosis is a type of cell division.

(i) State the purpose of meiosis.

[1]

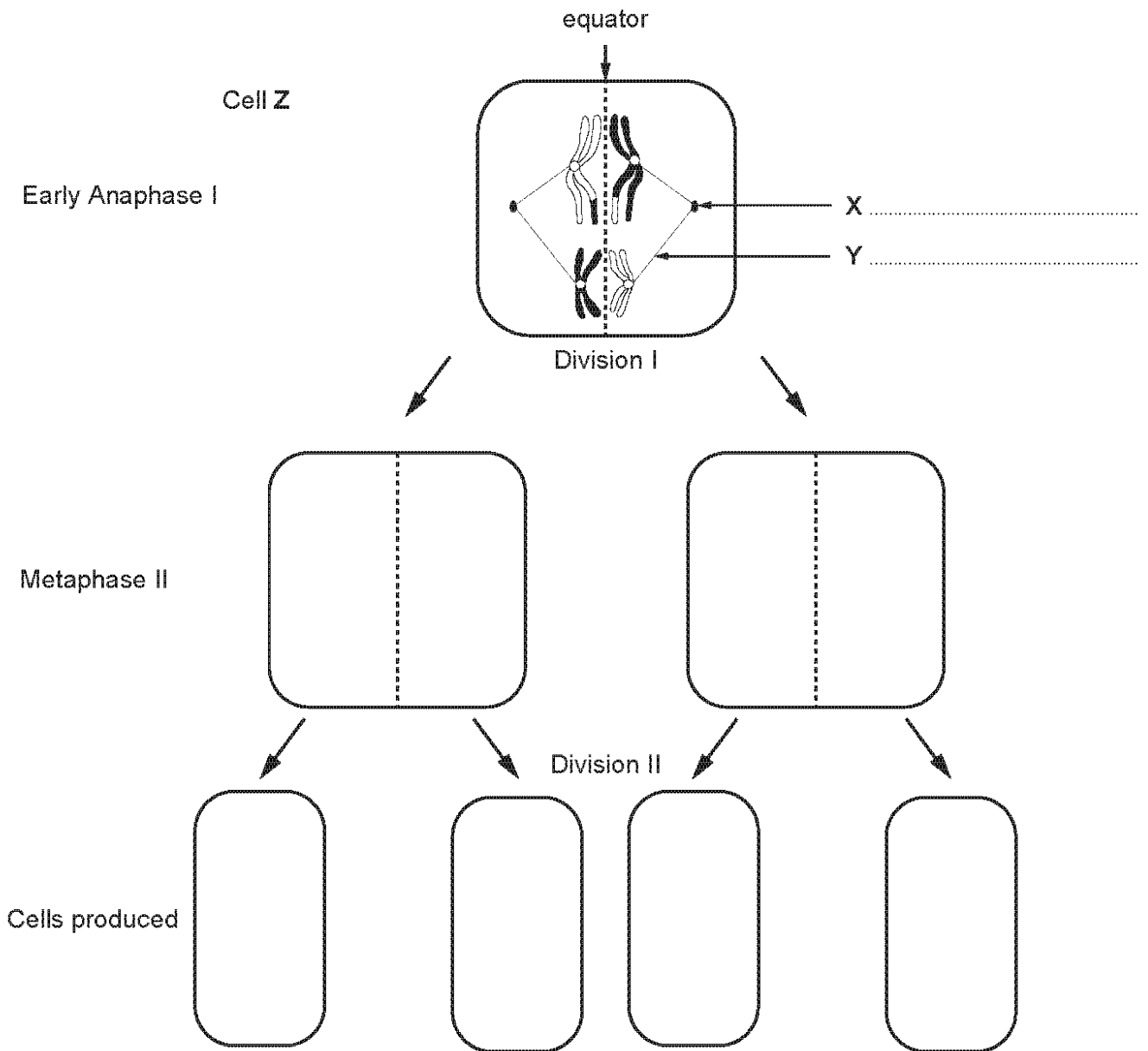
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(ii) Name the organs in animals where meiosis occurs.

[1]

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(b) The diagram below represents meiosis in a cell with two pairs of chromosomes.



(i) Label parts X and Y.

[1]

(ii) Draw chromosomes in the cell outlines for:

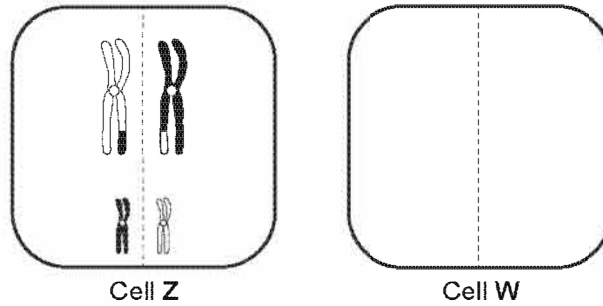
[4]

I. metaphase II

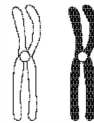
II. the cells produced

(c) The drawing of cell W below is an outline of another cell from the same individual as cell Z. Complete the drawing of cell W to show how independent assortment could produce an alternative outcome.

[1]



(d) The drawing below shows the two larger chromosomes from cell Z at a different stage of meiosis



(i) Name the stage of meiosis.

[1]

(ii) Explain with the aid of diagrams how the larger chromosomes in cell Z took on the appearance shown in part (c).

[2]

(iii) Name the process shown in your drawings.

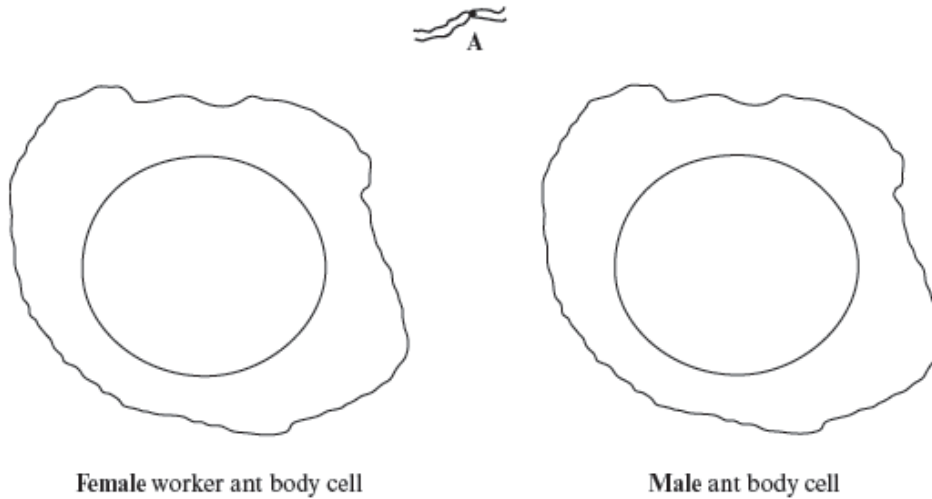
[1]



12

4. An Australian ant, *Myrmecia pilosula*, carries all its genetic information in a single pair of homologous chromosomes. Female worker ants are diploid, males are haploid.
- (a) Complete the drawings of the ant body (somatic) cells below, using drawings similar to structure A shown below to represent a single chromosome.

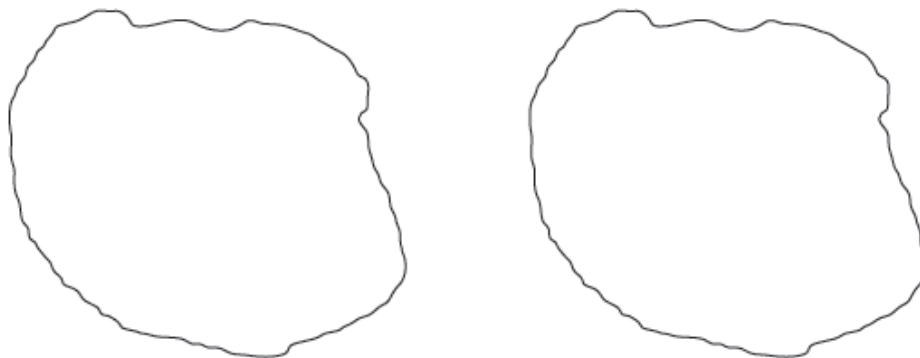
[2]



- (b) Using the cell outlines provided below, make labelled drawings to show the appearance of the female worker ant cells at the following stages.

[4]

- (i) metaphase of mitosis, (ii) anaphase of mitosis.



(iii) Adult ants emerge from pupae fully grown. Describe the purpose of mitosis in female worker ants.

[2]

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(iv) Suggest the additional purpose of mitosis in fully grown male ants.

[1]

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(v) In ant colonies only some ants, called 'queens', produce egg cells and lay eggs. Name the type of cell division that the 'queens' use to produce haploid egg cells.

[1]

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(vi) What is the significance of the queens producing haploid egg cells?

[1]

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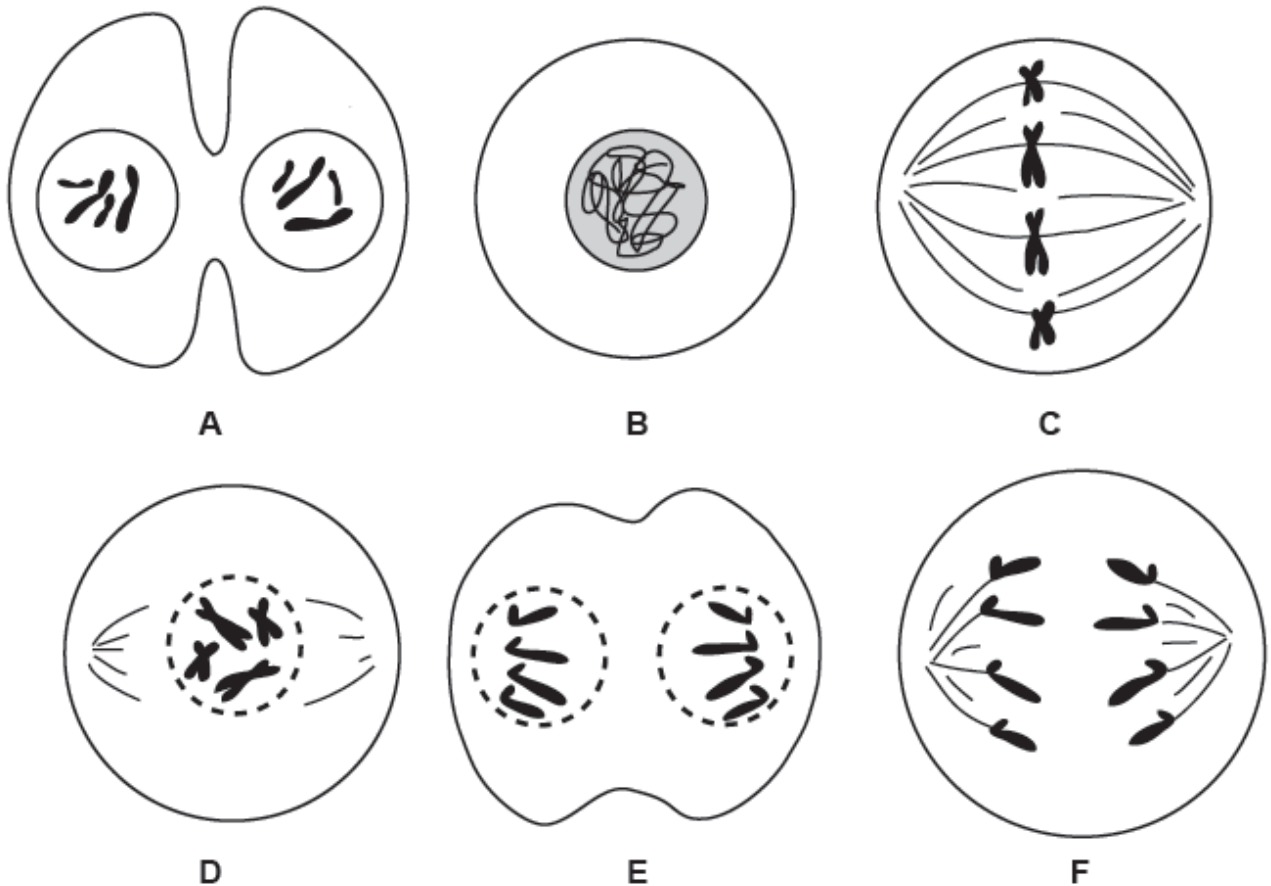
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(c) During a mating flight the queen collects sperm cells from male ants, which she stores in an organ called the spermatheca. The haploid egg cells from the queen's ovaries pass the spermatheca as they are laid. Some eggs are fertilised as they pass out, some eggs pass out unfertilised.

How will the ants that develop from fertilised egg cells differ from the ants that develop from unfertilised egg cells?

[1]

5. The diagrams below show the different stages of the cell cycle in a body cell from an animal

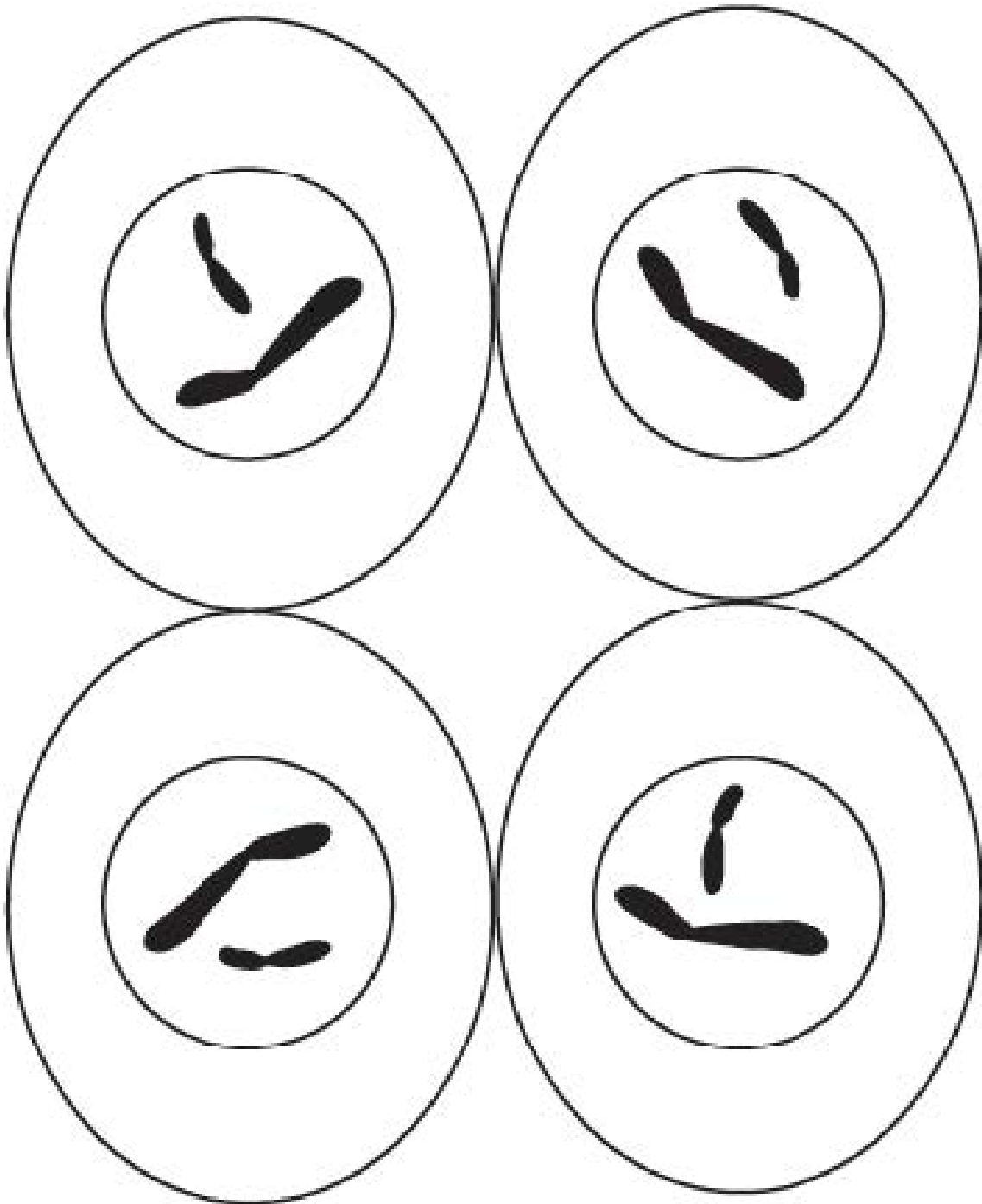


(a) (i) Put the stages from the diagrams above in the correct sequence. The last stage has been done for you.



(ii) Name the process represented in diagram A.

Cell division also occurs in the ovaries of animals. The diagram below shows the final stage of cell division in the ovary of the same animal.



(b) (i) Using the diagrams above, describe and explain one difference between these cells and those produced in part (a) opposite.

[2]

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(ii) Explain the importance of this type of cell division in the animal.

[2]

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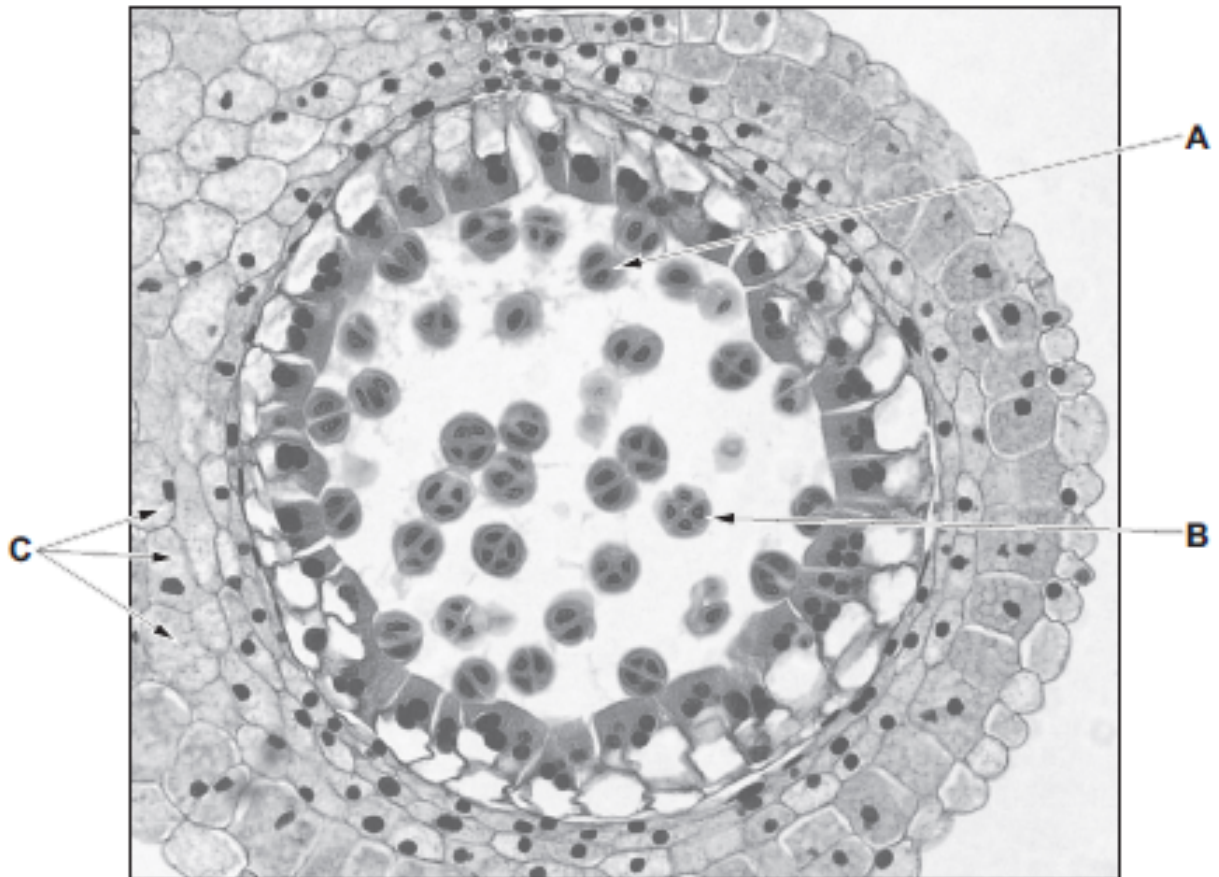
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6.

Mitosis and meiosis are both forms of nuclear division. Both types of nuclear division are involved in the production of gametes.

- (a) Image 1 below shows a section through part of an anther of *Lilium sp.* showing stages in the production of pollen grains.

Image 1



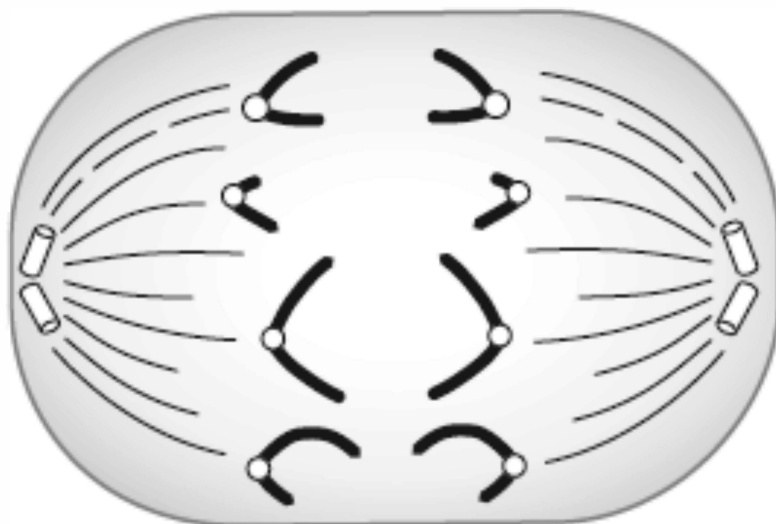
- (i) It was concluded that structure A had just completed meiosis I and structure B had just completed meiosis II. Explain how you would draw these conclusions from the photomicrograph. [1]

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- (ii) The cells labelled C are in interphase. Explain why nuclei are only visible in some cells and, where nuclei are visible, why they appear to be of different sizes. [2]

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(b) A drawing was made of an animal cell during anaphase. The diploid number in this cell is eight.



Deduce whether this cell is undergoing anaphase of mitosis, anaphase I of meiosis or anaphase II of meiosis. Explain your answer. [3]

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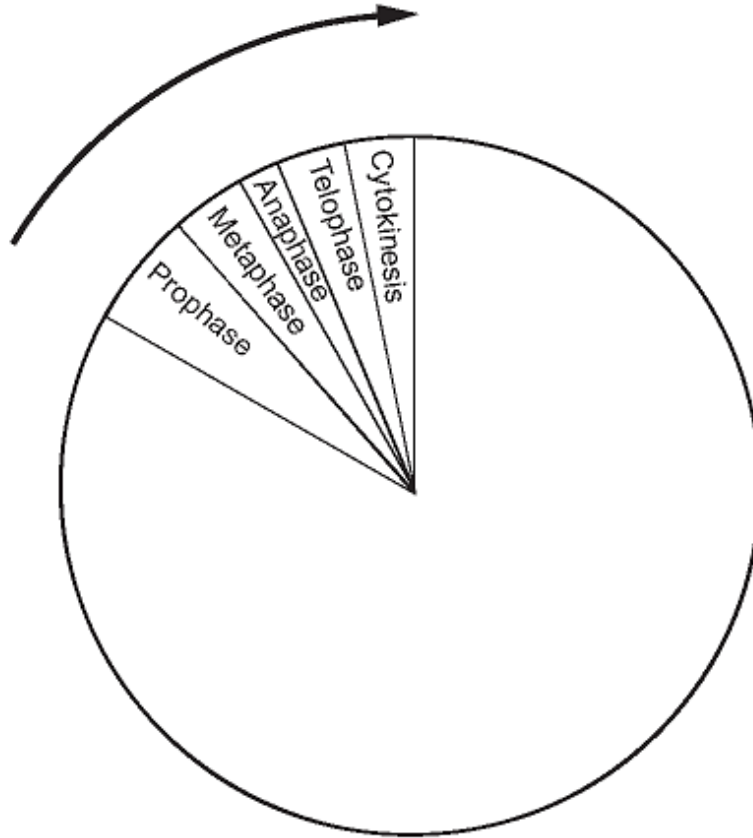
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7. The diagram below shows the relative lengths of the cell cycle in actively dividing cells taken from the root tip of a garlic plant.

Mitosis



- (a) Describe the changes that occur to a plant cell during prophase. [4]

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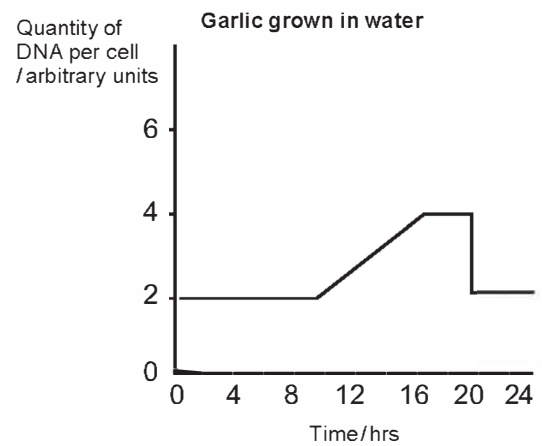
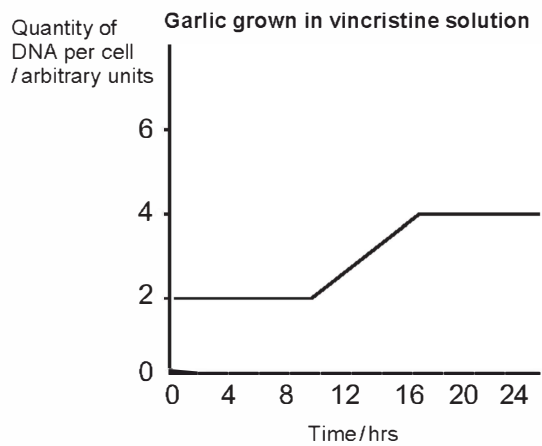
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(b) The percentage of cells in each stage of the cell cycle is proportional to the length of that stage. Using a microscope, a student observed 100 cells and found 5 undergoing prophase. If the total length of the cell cycle is 24 hours, calculate the length of prophase in minutes. Show your working.

[2]

Answer = minutes

(c) Vincristine is a chemical which inhibits mitosis by preventing the formation of the spindle fibres. Garlic bulbs were grown in a solution of vincristine and the quantity of DNA present in a cell from the root tip was measured over the 24 hour length of the cell cycle. The results are shown below together with the results from garlic bulbs grown in water.



Using your knowledge of the cell cycle, explain how the results of this experiment show that vincristine inhibits mitosis.

[3]

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- (d) Meiosis produces four daughter cells, whereas mitosis only produces two daughter cells. Describe **two other** ways in which the cells produced by meiosis would differ from those produced by mitosis. [2]

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11

8. (a) Complete the table to show whether each role applies to mitosis, meiosis or both. If the role applies put a tick (✓) and a cross (✗) where it does not apply.

<i>Role</i>	<i>Mitosis</i>	<i>Meiosis</i>
Involved in growth		
Produces variation		
Produces haploid cells		
Occurs in plants		

[4]

- (b) In the space below draw a labelled diagram to show a single chromosome as it appears during prophase of mitosis. [2]

- (c) Describe and explain what happens to chromosomes during anaphase of mitosis. [3]

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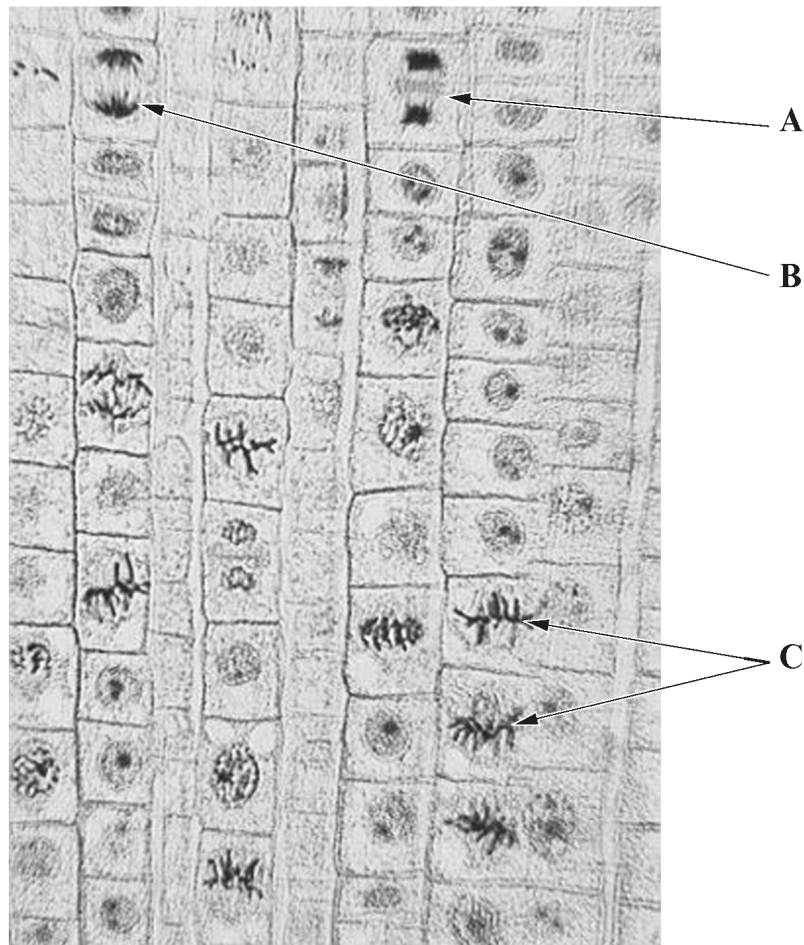
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- (d) Name the cell organelle responsible for the production of the spindle fibres. [1]

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9. The photograph below shows a preparation of garlic (*Allium sativum*) root tip undergoing cell division – the stages of the cell cycle are clearly visible.



- (a) (i) Name the stages shown in the diagram labelled **A** and **C**. [2]

Stage **A**

Stage **C**

- (ii) Describe and explain the events occurring during the stage labelled **B**. [2]

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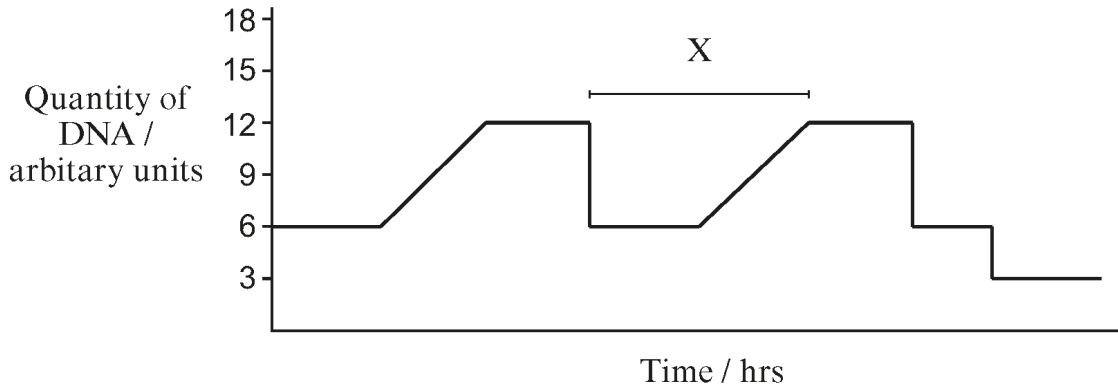
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(b) The graph below shows the relative quantity of DNA in an animal cell during **two** complete cell cycles.



(i) Name the stage in the cell cycle which is represented by the time period labelled X on the graph above. [1]

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(ii) Using evidence from the graph, give a reason for your answer in part (b)(i). [1]

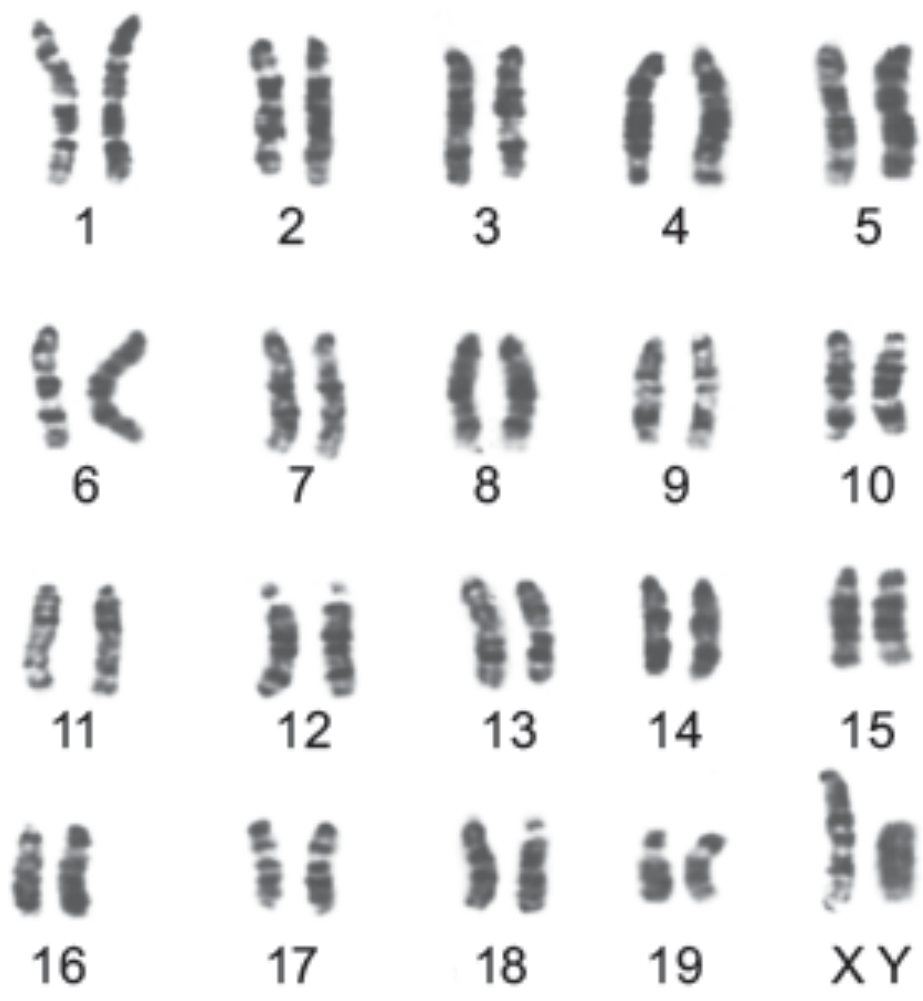
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(iii) State the type of nuclear division that is shown in the second cell cycle and explain how the evidence in the graph led you to this conclusion. [2]

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(Total 8 marks)

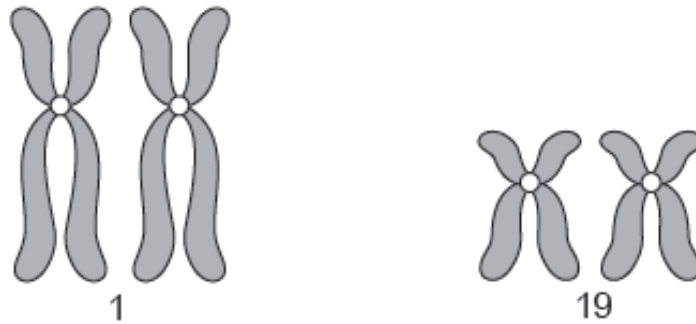
10. The photograph below shows the pairs of chromosomes found in a body cell of a mouse.



(a) What is the diploid number of the mouse?

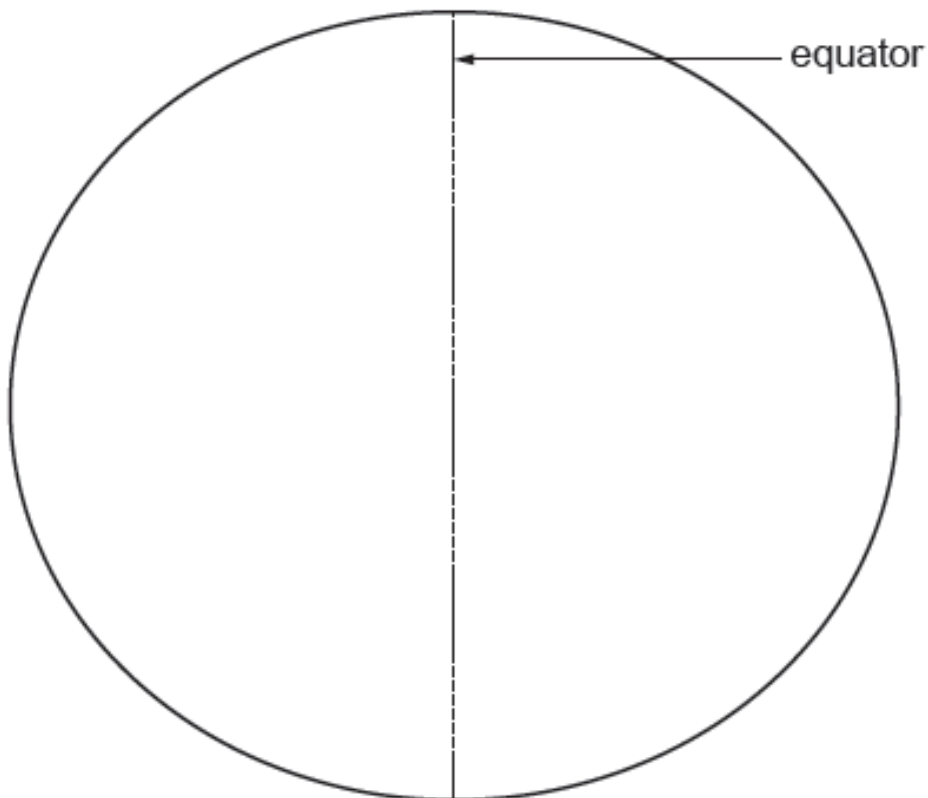
[1]

(b) The chromosomes in pairs 1 and 19 are commonly represented diagrammatically as:



(i) Using the cell outline below draw diagrams to show how these pairs of chromosomes are arranged in **metaphase I** of meiosis.

[1]

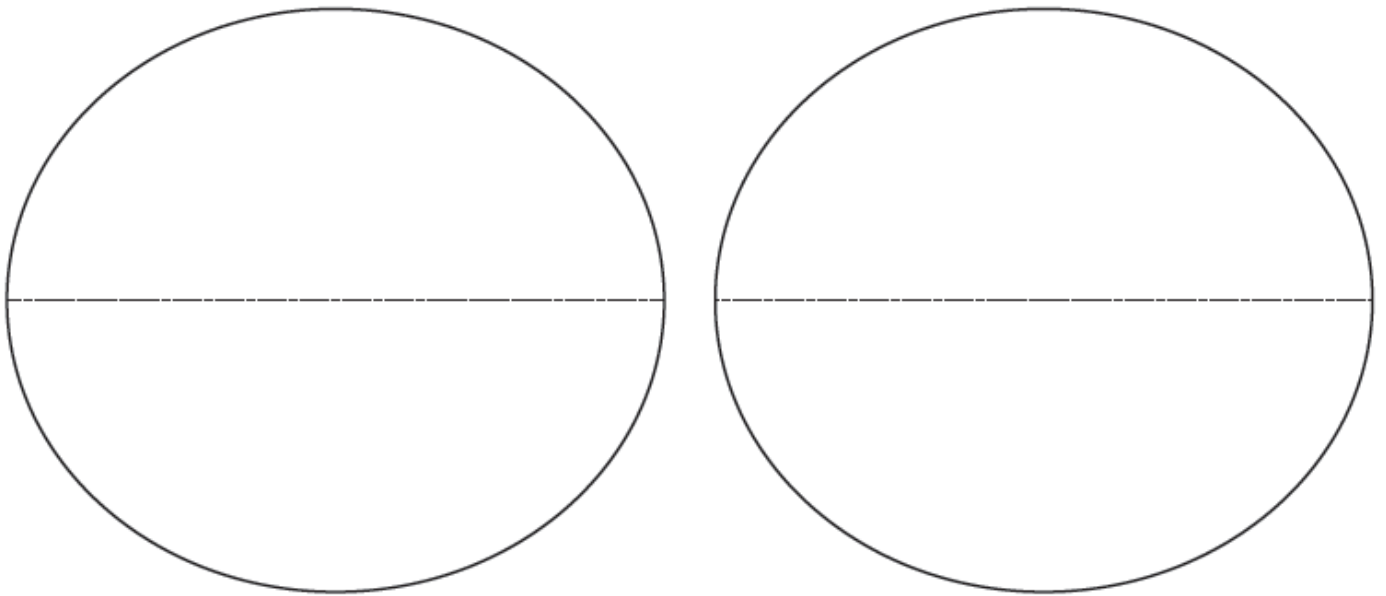


(ii) On your drawing label; chromatid, centromere, centriole, spindle fibres

[2]

(iii) Using the cell outlines below draw diagrams to show how the chromosomes would subsequently be arranged in **metaphase II** of meiosis.

[1]



(iv) State **three** ways in which meiosis contributes to variation in mouse offspring.

[3]

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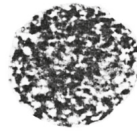
11. The photographs show chromosomes during the stages of mitosis.



H



I



J



K



L

(a) (i) Place the stages into the correct sequence. The first box has been completed. [1]

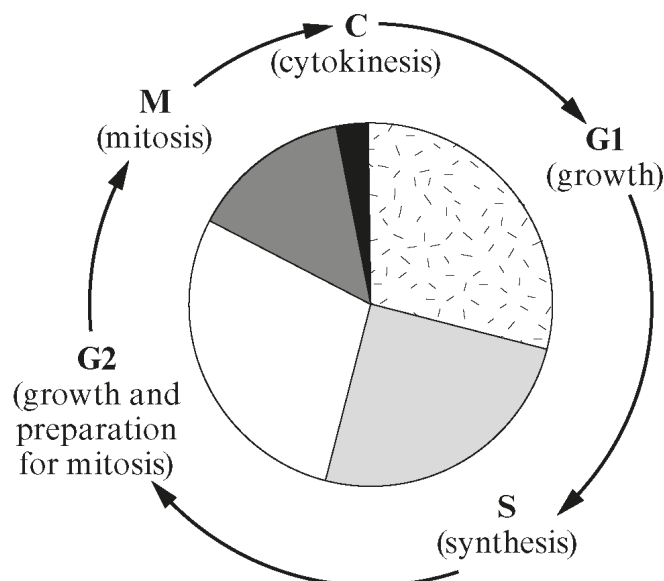
J

(ii) Name stages: [2]

I

L

(b) The diagram represents the events that take place during the cell cycle.



The table below shows the DNA content of a cell measured during one cell cycle.

<i>Stage</i>	<i>DNA content of cell/arbitrary units</i>
G1	20
S	20 increasing to 40
G2	40
M	40
C	40 decreasing to 20

(i) State the name of the period in the cell cycle that includes stages G1, S and G2. [1]

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(ii) State **two** events that occur during this period. [2]

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(c) Using information provided in the diagram and the table, explain why it is important that the DNA content of the cell increases during stage **S** and decreases during stage **C**. [2]

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(d) Explain how mitosis maintains genetic stability. [2]

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(Total 10 marks)

12. The photograph shows all the chromosomes from a blood cell of a mammal.



(a) (i) Explain why red blood cells could not have been used to produce the photograph of the chromosomes. [1]

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(ii) Use the photograph to deduce the sex of the mammal and explain your choice. [1]

.....

(iii) In this mammal, how many chromosomes would be present in [1]

I. a kidney cell;

II. gametes?

(iv) The circle below represents the outline of the mammal cell at metaphase I of meiosis, and the dotted line the equator of the cell. Complete the drawing to show the spindle and how the sex chromosomes as shown above would be arranged. [2]

