

Name	Date started	Target end date
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## GCE AS / A LEVEL – BIOLOGY UNIT 1 QUESTION PACK

1071-01 (Legacy BY1) · New spec Unit 1 Topic 7 · AS unit, first sat 2016, 80 marks, 1h 30min paper

# REVISE

.wales

## BIOLOGY – UNIT 1 · CELL DIVISION (MITOSIS & MEIOSIS)

### BY1.6 Cell division – cell cycle, mitosis and meiosis

*The cell cycle and the stages of mitosis (prophase to telophase), plus the significance of meiosis for haploid gamete production and genetic variation.*

LEGACY 2008 SPECIFICATION

### Estimated time for entire question pack: ~2 h 16 min

*Derived from the legacy BY1 paper's pace of ~1.1 min/mark, padded for long-prose answers (85 marks over 9 questions).*

*You are advised to **not** attempt to complete all of this in one sitting.*

### ABOUT THIS QUESTION PACK

This is a **comprehensive practice question pack**, not a single mock paper. It contains every question from the legacy WJEC BY1 papers (2008 modular spec, 2011–2017) that maps onto new-spec AS Unit 1 Topic 7 (1.6).

Questions are ordered by source paper date.

### INSTRUCTIONS

Use black ink or black ball-point pen. Show all working – quality of written communication will affect marks. A calculator is allowed. Diagrams included in answers must be fully annotated.

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Q	Source	Max	Mark
1	Jan 14 Q2	6	
2	Jan 13 Q1	8	
3	Jan 12 Q6	10	
4	Jun 13 Q4	9	
5	Jun 12 Q4	12	
6	Jun 15 Q4	11	
7	Jun 17 Q3	9	
8	Jun 16 Q7	10	
9	Jun 11 Q8	10	
<b>Total</b>		<b>85</b>	

# Cell Division (Mitosis & Meiosis) – what the new spec asks

WJEC GCE AS / A Level Biology (from 2015) · Unit 1: Basic Biochemistry & Cell Organisation · Topic 1.6.

## Cell cycle

- Interphase: G<sub>1</sub> (growth), S (DNA replication), G<sub>2</sub> (preparation).
- M phase: mitosis + cytokinesis.
- Most of cycle (~90%) spent in interphase.

## Mitosis

- Prophase: chromosomes condense; nuclear envelope breaks down.
- Metaphase: chromosomes align on equator; spindle attached.
- Anaphase: sister chromatids pulled to poles.
- Telophase: nuclear envelopes re-form; chromosomes decondense.

## Mitosis – significance

- Produces genetically identical diploid daughter cells.
- Growth, repair, asexual reproduction.
- Mitotic index = (cells in mitosis / total) × 100.

## Meiosis

- Two divisions – produces 4 haploid gametes.
- Crossing over (prophase I) – chiasmata between bivalents.
- Independent assortment (metaphase I) of homologous pairs.
- Random fertilisation ⇒ genetic variation in offspring.

# Cell Division (Mitosis & Meiosis) in one page

Quick-reference notes – revisit before each question.

## Cell cycle

G<sub>1</sub> (growth) → S (DNA replication) → G<sub>2</sub> (preparation) → M (mitosis + cytokinesis).

Most cells spend ~90% of cycle in interphase.

## Prophase

Chromosomes condense and become visible.

Each = 2 sister chromatids joined at centromere.

Nuclear envelope breaks down; spindle forms.

## Metaphase & anaphase

Metaphase: chromosomes align on equator.

Anaphase: centromeres split; sister chromatids pulled to poles.

## Telophase & cytokinesis

Chromosomes decondense at poles.

Nuclear envelopes re-form.

Cytokinesis: cell membrane (animal) or cell plate (plant) divides cytoplasm.

## Mitosis – importance

Genetically identical diploid daughter cells.

Growth, tissue repair, asexual reproduction.

Mitotic index = (cells in mitosis / total) × 100.

## Meiosis

2 divisions → 4 haploid gametes.

Crossing over (prophase I) at chiasmata.

Independent assortment (metaphase I).

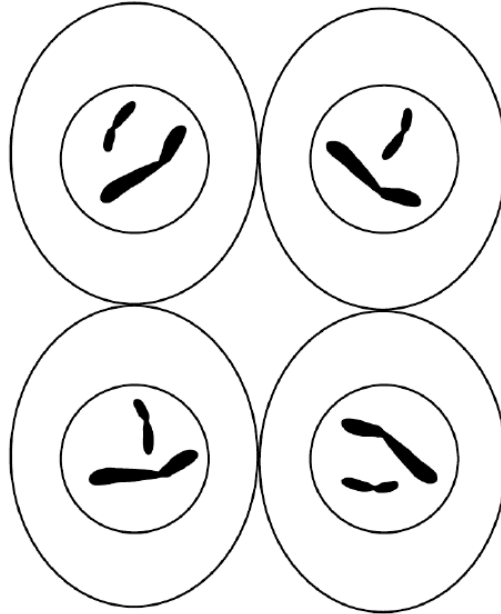
Random fertilisation ⇒ offspring variation.





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.

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- (b) (i) Using the diagrams above, describe and explain **one** difference between these cells and those produced in part (a) opposite. [2]

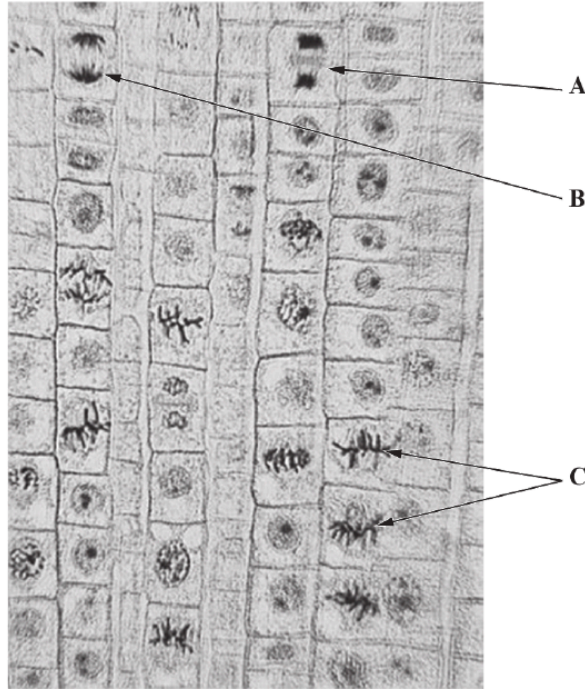
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- (ii) Explain the importance of this type of cell division in the animal. [2]

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1. 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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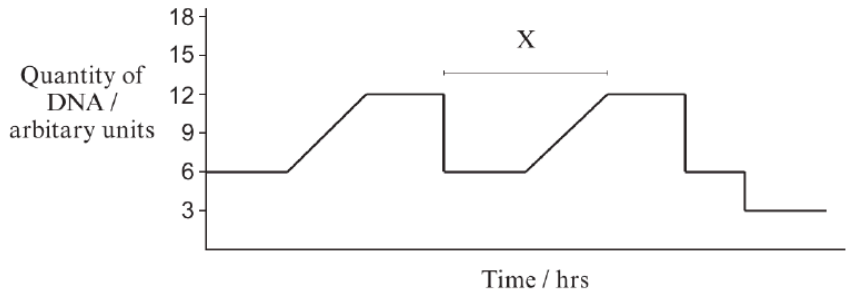
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(b) The graph below shows the relative quantity of DNA in an animal cell during two complete cell cycles.



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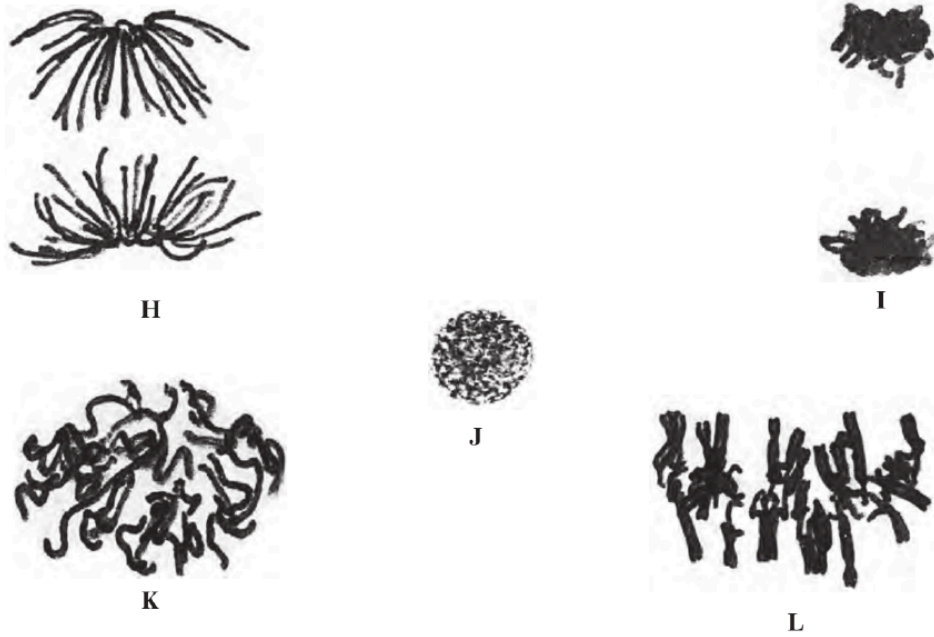
(iii) State the type of nuclear division that is shown in the second cell cycle and explain how the evidence in the graph led you to this conclusion. [2]

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(Total 8 marks)

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



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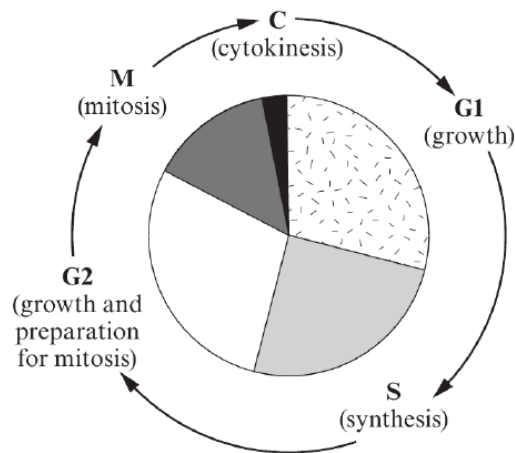
(a) (i) Place the stages into the correct sequence. The first box has been completed. [1]

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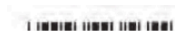
(d) Explain how mitosis maintains genetic stability. [2]

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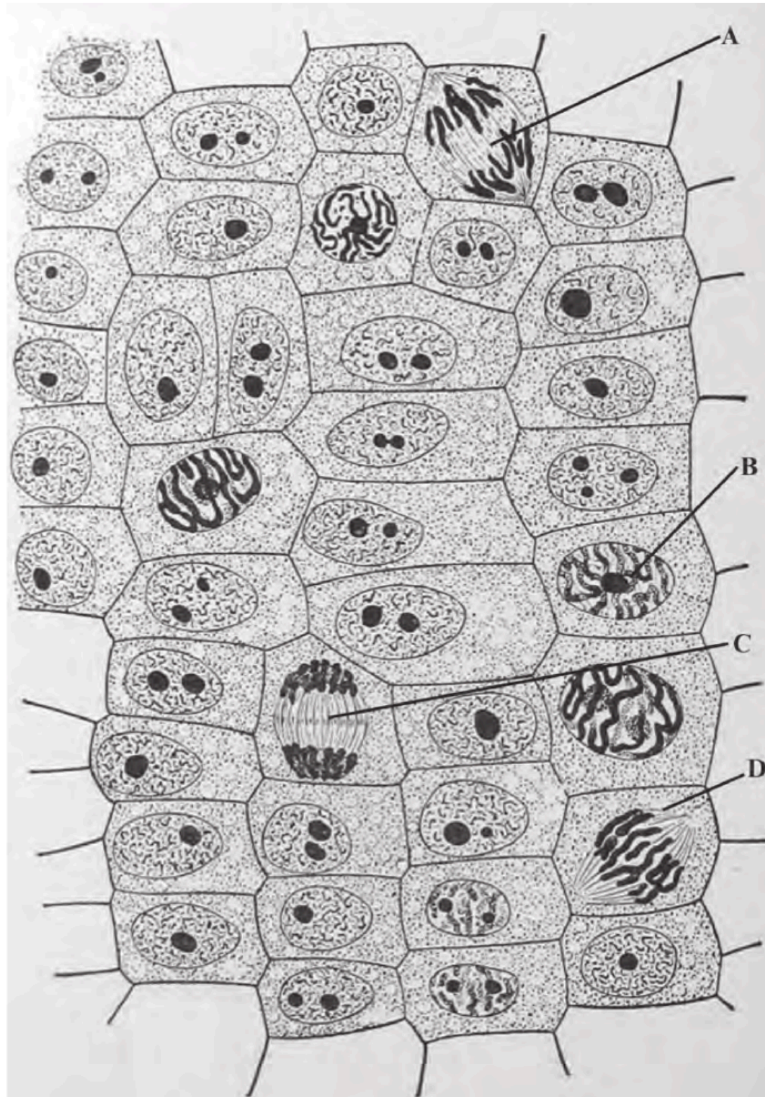
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**(Total 10 marks)**



4. 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**. [4]

**A** .....

**B** .....

**C** .....

**D** .....

(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: .....

Explanation .....

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(d) How would cells produced by meiosis differ from those produced by mitosis? [2]

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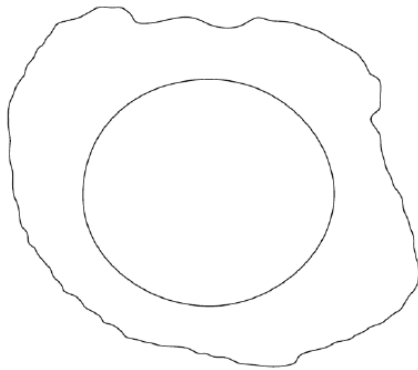
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(Total 9 marks)

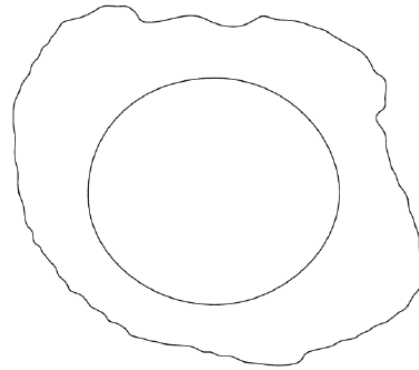
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4. An Australian ant, *Myrmecia pilosula*, carries all its genetic information in a **single pair** of homologous chromosomes. Female worker ants are **diploid**, males are **haploid**.

- (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]



Female worker ant body cell

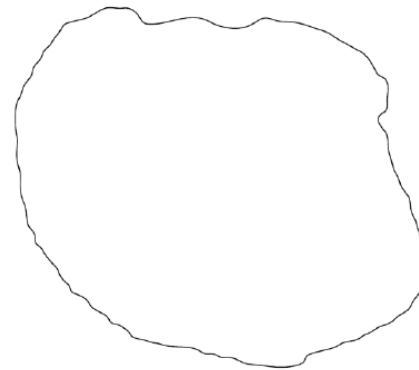
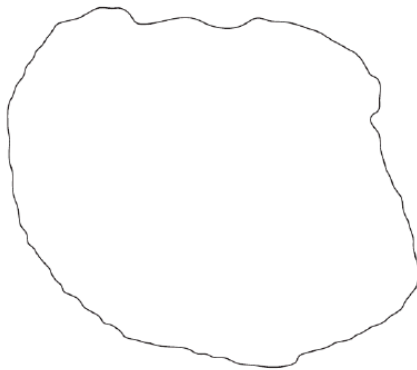


Male ant body cell

- (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.



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(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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(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]

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(Total 12 marks)

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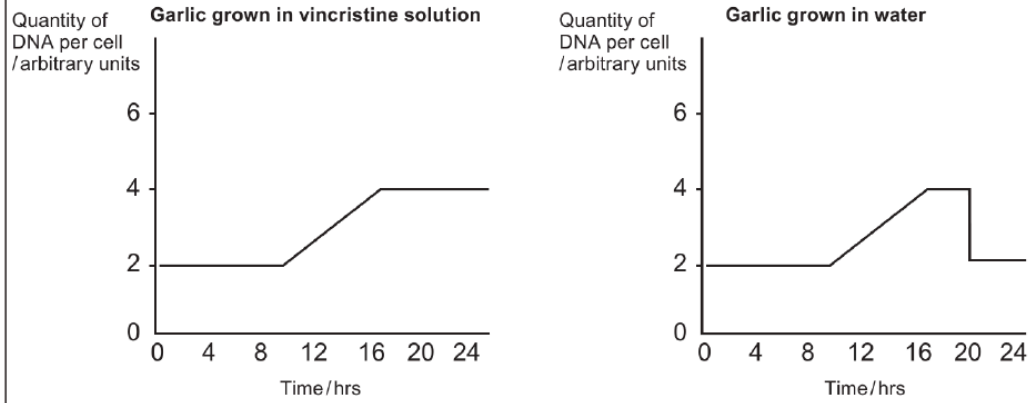
- (b) The percentage of cells in each stage of the cell cycle is proportional to the length of that stage. Using a microscope, a student observed 100 cells and found 5 undergoing prophase. If the total length of the cell cycle is 24 hours, calculate the length of prophase in minutes. Show your working. [2]

Answer = ..... minutes

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(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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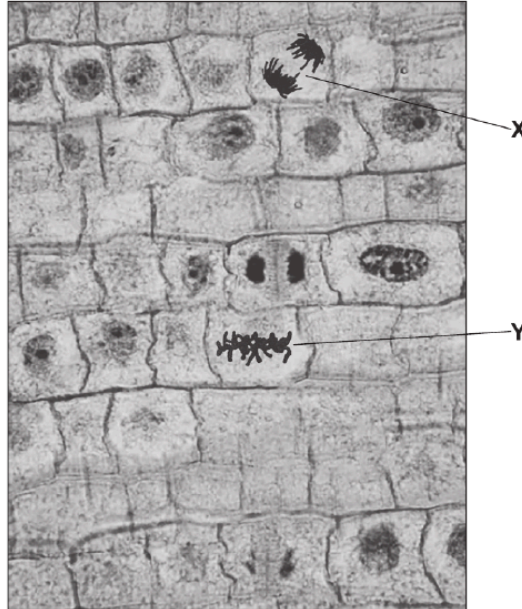
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3. Students investigated the cell cycle by performing a root tip squash using *Allium cepa* (onion) cells.

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The high power image shows the view that is typical when observing an allium root tip squash that was cut and fixed after 2 days of growing.



- (a) (i) Identify the stages labelled X and Y. [2]

X .....

Y .....

- (ii) Describe the events that take place in an onion cell during interphase to prepare the cell for mitosis. [3]

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The percentage of cells undergoing mitosis at any one time can be used to estimate the duration of each phase.

A total of 980 cells in a root tip squash of an onion root were observed.

The number of cells observed in each phase of mitosis is shown below.

Stage	Number of observed cells in each phase	Duration of stage /minutes
prophase	109	
metaphase	34	25
anaphase	16	12
telophase	26	19

- (b) The duration of each stage is proportional to the number of cells observed. A typical onion root cell takes 720 minutes to complete one cell cycle. Use the table above to calculate the duration of prophase to the nearest minute. [2]

Duration of prophase = ..... minutes

- (c) Describe **two** ways in which the nuclei of cells produced in the root tip would differ from the nuclei of pollen grains (gametes). [2]

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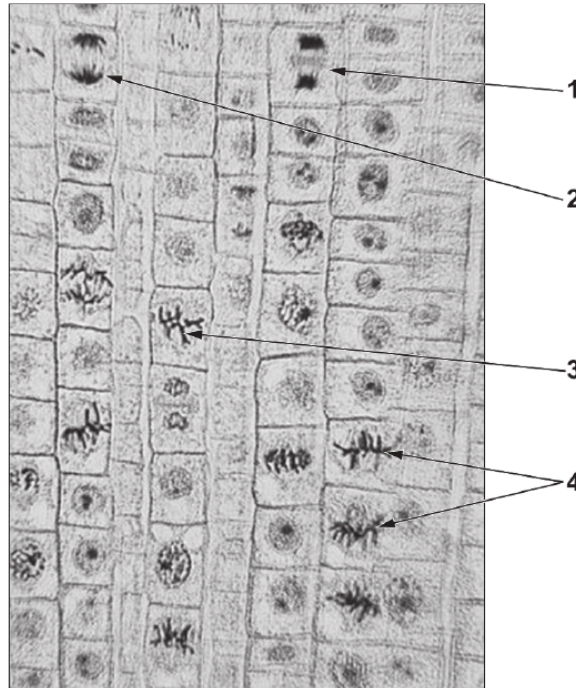
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7. Answer **one** of the following questions.

Any diagrams included in your answer must be fully annotated.

**Either,** (a) The photomicrograph below shows a root tip squash. With reference to the cells labelled 1-4, describe and explain the sequence of events in mitosis. [10]



**Or,** (b) Explain what is meant by an immobilised enzyme and with reference to suitable examples, discuss the advantages of their application in fields such as medicine and industry. [10]

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A large rectangular area for writing, containing horizontal dotted lines for guidance.

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**END OF QUESTION PACK**

9 questions · 85 marks · ~2 h 16 min

Source: WJEC BY1 (2008 modular spec, 2011–2017)

Curated for WJEC Biology 2015 spec AS Unit 1 – Topic 7 (1.6)

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