Required Practical 2, Mitosis and Root Tip Squashes: AQA A Level Biolo

13 questions · 25 marks · about 32 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · AS Paper 2 · June 2018 · Q05.1 · 2 marks

0 5 . 1 A student prepared a stained squash of cells from the tip of an onion root and observed it using an optical microscope.

During the preparation of the slide, he:

- cut the first 5 mm from the tip of an onion root and placed it on a glass slide
- covered this tip with a drop of stain solution and a cover slip
- warmed the glass slide
- pressed down firmly on the cover slip.

He identified and counted nuclei in different stages of the cell cycle.

Explain why the student:

[2 marks]

1. used only the first 5 mm from the tip of an onion root.

2. pressed down firmly on the cover slip.

Questions, mark schemes and examiners' report extracts © AQA.

Question 2 · A level Paper 3 · June 2022 · Q03.1 · 2 marks

0 3 A student prepared a stained squash of cells from the root tips of garlic to calculate a mitotic index. He:

1. cut the end 5 mm from 10 garlic roots
2. placed the root tips into a Petri dish containing 5 cm^3 of hydrochloric acid for 12 minutes
3. rinsed the root tips in distilled water
4. placed one of the root tips on a microscope slide and added toluidine blue stain
5. placed a coverslip onto the microscope slide, and gently pressed the coverslip downwards on the root tip
6. observed the root tip using an optical microscope.

0 3 . 1 Suggest why the student soaked the root tips in hydrochloric acid in step **2**.

[2 marks]

Question 3 · AS Paper 1 · June 2023 · Q08.1 · 1 mark

0 8 . 1 A student prepared a plant root to observe cells undergoing mitosis.

He put the root in a small bottle of hydrochloric acid in a 40 °C water bath.

Why did he put the plant root in acid?

[1 mark]

Questions, mark schemes and examiners' report extracts © AQA.

Question 4 · information from earlier in the question

0 3 A student prepared a stained squash of cells from the root tips of garlic to calculate a mitotic index. He:

1. cut the end 5 mm from 10 garlic roots
2. placed the root tips into a Petri dish containing 5 cm^3 of hydrochloric acid for 12 minutes
3. rinsed the root tips in distilled water
4. placed one of the root tips on a microscope slide and added toluidine blue stain
5. placed a coverslip onto the microscope slide, and gently pressed the coverslip downwards on the root tip
6. observed the root tip using an optical microscope.

Question 4 · A level Paper 3 · June 2022 · Q03.2 · 2 marks

0 3 . 2 Pressing the coverslip downwards enabled the student to observe the stages of mitosis clearly.

Explain why.

[2 marks]

Question 5 · AS Paper 1 · June 2023 · Q08.2 · 2 marks

0 8 . 2 State **two** precautions required when working with hydrochloric acid.

[2 marks]

1

2

Questions, mark schemes and examiners' report extracts © AQA.

Question 6 · AS Paper 1 · June 2022 · Q07.2 · 3 marks

0 7 . 2 Describe how you would determine a **reliable** mitotic index (MI) from tissue observed with an optical microscope.

Do **not** include details of how you would prepare the tissue observed with an optical microscope.

[3 marks]

Question 7 · AS Paper 2 · June 2018 · Q05.4 · 2 marks

0 5 . 4 Describe and explain what the student should have done when counting cells to make sure that the mitotic index he obtained for this root tip was accurate.

[2 marks]

Questions, mark schemes and examiners' report extracts © AQA.

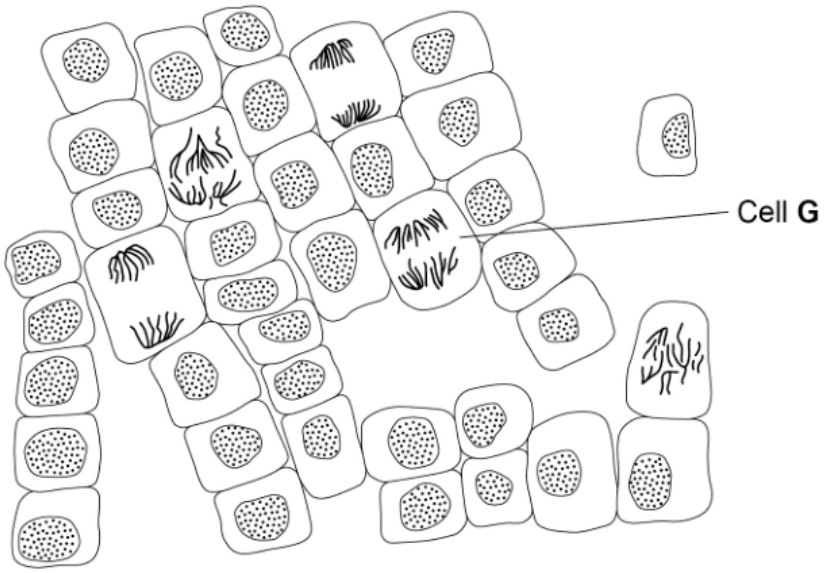
Question 8 · information from earlier in the question

0 3 A student prepared a stained squash of cells from the root tips of garlic to calculate a mitotic index. He:

1. cut the end 5 mm from 10 garlic roots
2. placed the root tips into a Petri dish containing 5 cm^3 of hydrochloric acid for 12 minutes
3. rinsed the root tips in distilled water
4. placed one of the root tips on a microscope slide and added toluidine blue stain
5. placed a coverslip onto the microscope slide, and gently pressed the coverslip downwards on the root tip
6. observed the root tip using an optical microscope.

Figure 6 shows the student's drawing of one field of view.

Figure 6



Question 8 · A level Paper 3 · June 2022 · Q03.4 · 1 mark

0 3 . 4 Use **Figure 6** to calculate a mitotic index for the cells in this field of view.

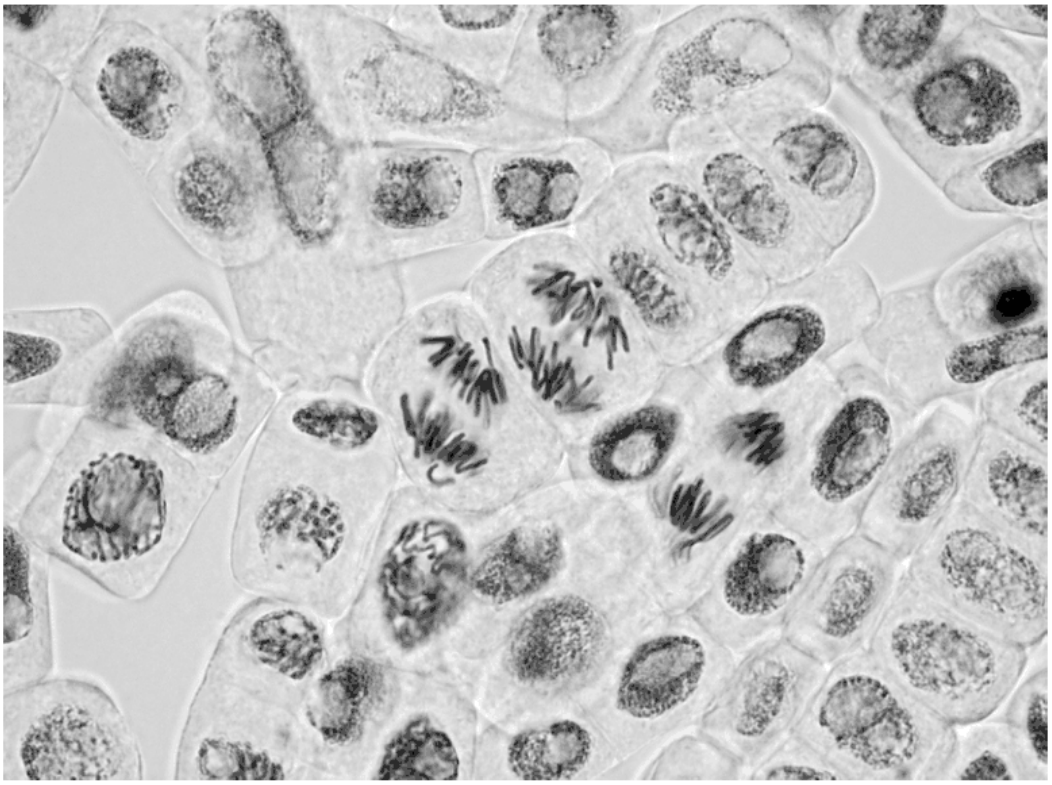
[1 mark]

Mitotic index _____

Questions, mark schemes and examiners' report extracts © AQA.

Figure 2 shows the cells the student saw in one field of view. He used this field of view to calculate the length of time these onion cells spent in anaphase of mitosis.

Figure 2



0 5 . 2 Scientists have found the mean length of time spent by onion cells in anaphase of mitosis is 105 minutes. They also found the cell cycle of cells in the onion root shown in **Figure 2** takes 1080 minutes.

32 whole cells are shown in **Figure 2**.

Use this information and **Figure 2** to calculate the length of time the cells of this onion root are in anaphase **and** then calculate the percentage difference between your answer and the mean length of time found by the **scientists**.

Show your working.

[2 marks]

Answer = _____ %

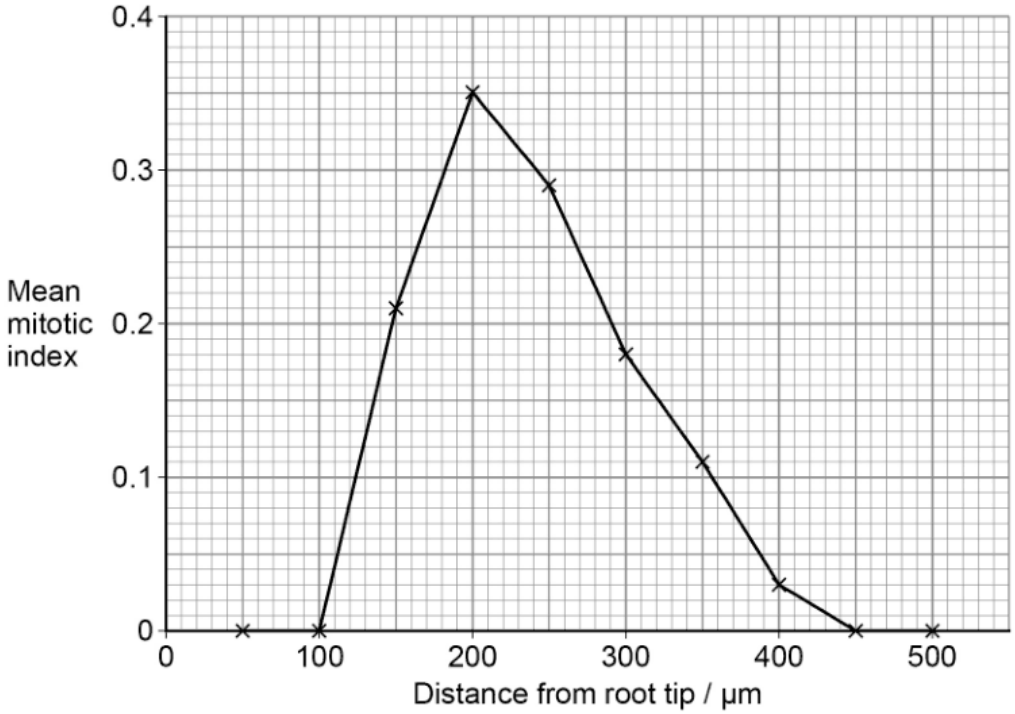
Questions, mark schemes and examiners' report extracts © AQA.

Question 10 · information from earlier in the question

0 8 . 3 Scientists determined the mean mitotic index at 50 µm intervals away from the root tip in 10 young plant roots.

Figure 7 shows the scientists' results.

Figure 7



State the null hypothesis for this investigation.

Name the statistical test needed to determine whether the difference between the mean mitotic index at 200 µm and at 300 µm is significant.

[2 marks]

Questions, mark schemes and examiners' report extracts © AQA.

Question 10 · AS Paper 1 · June 2023 · Q08.4 · 2 marks

0 8 . 4 The scientists recorded these measurements from the tissue located at 200 μm from the root tip.

Area of field of view = 0.2 mm^2
Mean area of one cell = 3495 μm^2

Use this information and **Figure 7** to calculate the number of cells undergoing mitosis in this location.

Assume there are no spaces between the cells.

Show your working.

[2 marks]

_____ cells

Question 11 · information from earlier in the question

0 3 A student prepared a stained squash of cells from the root tips of garlic to calculate a mitotic index. He:

1. cut the end 5 mm from 10 garlic roots
2. placed the root tips into a Petri dish containing 5 cm^3 of hydrochloric acid for 12 minutes
3. rinsed the root tips in distilled water
4. placed one of the root tips on a microscope slide and added toluidine blue stain
5. placed a coverslip onto the microscope slide, and gently pressed the coverslip downwards on the root tip
6. observed the root tip using an optical microscope.

Questions, mark schemes and examiners' report extracts © AQA.

Question 11 · A level Paper 3 · June 2022 · Q03.5 · 2 marks

0 3 . 5 Other students in the class followed the same method, but calculated different mitotic indices.

Apart from student errors, suggest **two** explanations why.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 12 · AS Paper 1 · June 2023 · Q08.5 · 2 marks

0 8 . 5 Another student compares the mitotic index in the roots of two different species.

Give **two** considerations within her method to ensure this comparison is valid.

[2 marks]

1 _____

_____

_____

2 _____

_____

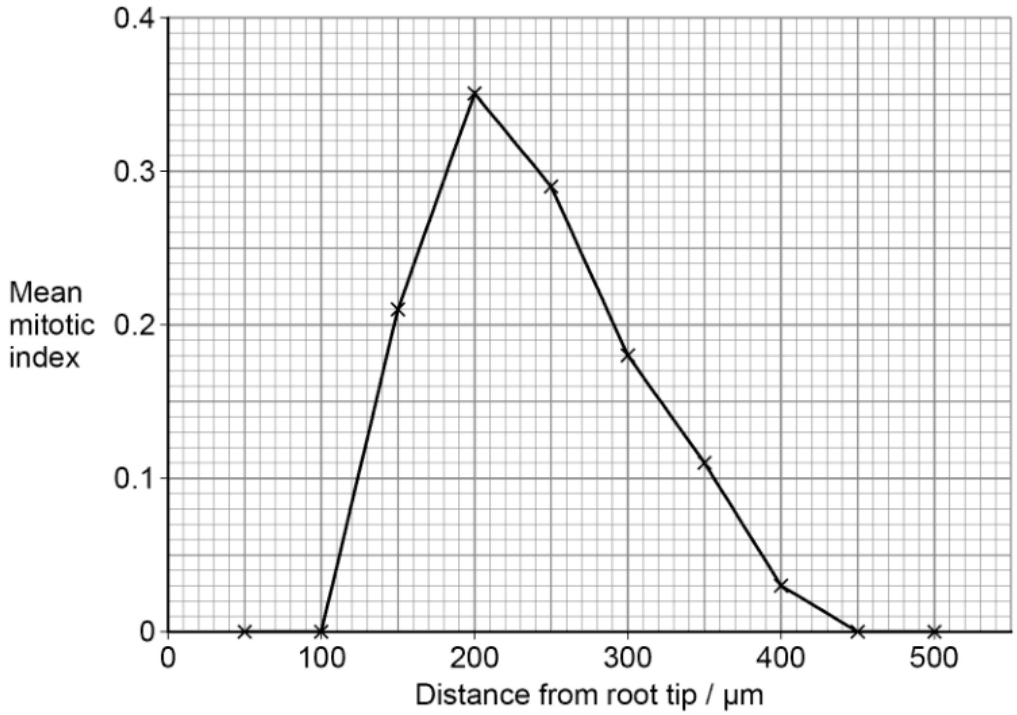
_____

Questions, mark schemes and examiners' report extracts © AQA.

0 8 . 3 Scientists determined the mean mitotic index at 50 μm intervals away from the root tip in 10 young plant roots.

Figure 7 shows the scientists' results.

Figure 7



State the null hypothesis for this investigation.

Name the statistical test needed to determine whether the difference between the mean mitotic index at 200 μm and at 300 μm is significant.

[2 marks]

Null hypothesis _____

_____

_____

Statistical test _____

Questions, mark schemes and examiners' report extracts © AQA.

Mark schemes

Question 1 · AS Paper 2 · June 2018 · Q05.1 · 2 marks

05.1	1. Where dividing cells are found / mitosis occurs; **OR** No dividing cells / mitosis in tissue further away / more than 5mm from tip; **OR** To get (soft) tissue that will squash; **OR** Length that will fit under cover slip; 2. Single / thin layer of cells / spread out cells **so** light passes through (making cells / nuclei visible);	2

1. Accept most dividing cells
2. Accept thin layer of tissue
2. Ignore to see cells clearly

Questions, mark schemes and examiners' report extracts © AQA.

Question 2 · A level Paper 3 · June 2022 · Q03.1 · 2 marks

03.1	1. To break down links between cells/cell walls **OR** To separate cells/cell walls **OR** To break down/hydrolyse cellulose/cell wall; 2. Allowing the stain to pass/diffuse into the cells **OR** Allowing the cells to be (more easily) squashed; 3. To stop mitosis;	2 max (2 x AO2)

1. Ignore references to any bonds
3. Accept to stop cell division/cell cycle

Questions, mark schemes and examiners' report extracts © AQA.

Question 3 · AS Paper 1 · June 2023 · Q08.1 · 1 mark

08.1	To break down links between cells/cell walls **OR** To separate cells/cell walls **OR** To break down/hydrolyse cellulose/cell wall **OR** Allowing the stain to pass/diffuse into the cells **OR** Allowing the cells to be (more easily) squashed **OR** To stop mitosis;	1 (AO1)	Accept: To stop mitosis continuing Accept: To stop cell division Accept: To stop the cell cycle Ignore references to enzymes

Question 4 · A level Paper 3 · June 2022 · Q03.2 · 2 marks

03.2	1. To create a single/thin layer of cells **OR** To spread out cells; 2. So that light could pass through;	2 (2 x AO3)

Question 5 · AS Paper 1 · June 2023 · Q08.2 · 2 marks

08.2	1. Eye protection; 2. Gloves; 3. Add <u>water</u> to spills (immediately); 4. Do not pour away down sink;	2 max (2 x AO1)	1. Accept wear goggles Ignore references to using dilute acid

Questions, mark schemes and examiners' report extracts © AQA.

07.2	1. Count cells in mitosis in field of view; 2. Divide this by total number of cells in field of view; 3. Repeat many/at least 5 times **OR** Select (fields of view) at random;	3 (3 x AO1)

1. and 2. Max 1 if 'field of view' not mentioned

3. Accept 'multiple' for 'many'

3. Ignore 'several'

Ignore conversion of MI into a percentage.

Questions, mark schemes and examiners' report extracts © AQA.

Question 7 · AS Paper 2 · June 2018 · Q05.4 · 2 marks

05.4	Description; Explanation; E.g, 1. Examine large number of fields of view / many cells; 2. To ensure representative sample; **OR** 3. Repeat count; 4. To ensure figures are correct; **OR** 5. Method to deal with part cells shown at edge /count only whole cells; 6. To standardise counting;	2 max

Mark as pairs only 1. Accept large number / 20 or more for many 2. Accept typical / reliable

Question 8 · A level Paper 3 · June 2022 · Q03.4 · 1 mark

03.4	0.1 / 0.13 / 0.128;	1 (AO2)	Accept any correct rounding of 0.128205128205128 Reject answers expressed as a percentage

Questions, mark schemes and examiners' report extracts © AQA.

Question 9 · AS Paper 2 · June 2018 · Q05.2 · 2 marks

05.2	3.57 / 3.6 / 3.7 / 3.71 / 3.8 (%);;	2	If the answer includes additional decimal places, award the marks if it would round to a correct answer There are 3 cells in anaphase Accept for 1 mark, 101.25 / 101 (students estimate in minutes) OR 3.75 (difference between scientist estimate and student's estimate in minutes) Ignore plus or minus signs

Question 10 · AS Paper 1 · June 2023 · Q08.4 · 2 marks

08.4	Correct answer within the range 19.95 to 20.03= **2 marks**;; Incorrect answer of 57 or 57.2 (correct unit conversion and correct division) = **1 mark** **OR** Incorrect answer of 2×10^{-5} (no unit conversion, correct division and correct × 0.35) = **1 mark** **OR** Incorrect answer of 2×10^{x} except 20 e.g.0.2/2/200/2000 (incorrect conversion, correct division and × 0.35); = **1 mark**	2 (2 x AO2)

Questions, mark schemes and examiners' report extracts © AQA.

Question 11 · A level Paper 3 · June 2022 · Q03.5 · 2 marks

03.5	1. (Garlic roots) are a different age **OR** (Garlic) grown in different conditions; 2. (Root tips) from different (garlic) plants/bulbs/species; 3. Single field of view is not representative of a root tip **OR** (Other) students may have looked at more fields of view **OR** (Other) students may have calculated a mean; 4. (Different fields of view are from) different parts of the root tip; 5. Cells/roots undergo mitosis/cell division at different times/rates;	2 max (2 x AO3)

1. Accept suitable descriptions of conditions, eg in different temperatures
3. Accept 'samples' for 'fields of view'
4. Reject different sized fields of view
4. Reject different number of cells (per field of view)

Questions, mark schemes and examiners' report extracts © AQA.

Question 12 · AS Paper 1 · June 2023 · Q08.5 · 2 marks

08.5	**Max 2** from 1. Roots/plant of the same age; 2. Same growing conditions (for all roots); 3. Same distance from root tip; 4. Same time in acid **OR** Same temperature of acid; 5. Same concentration of acid; 6. Same pressure of squash; 7. Several fields of view (for each species); 8. Same time of day;	2 max (2 x AO3)	2. Accept description of growing conditions

Question 13 · AS Paper 1 · June 2023 · Q08.3 · 2 marks

08.3	1. There is no difference between the mitotic index (at 200 and 300 μm); 2. t-test;	2 (2 x AO3)

1. Ignore reference to 'significant'
1. Reject correlation

Questions, mark schemes and examiners' report extracts © AQA.