Microscopy, Drawing and Dissection (Specified Practicals): Eduqas A Level Biology Exam Questions

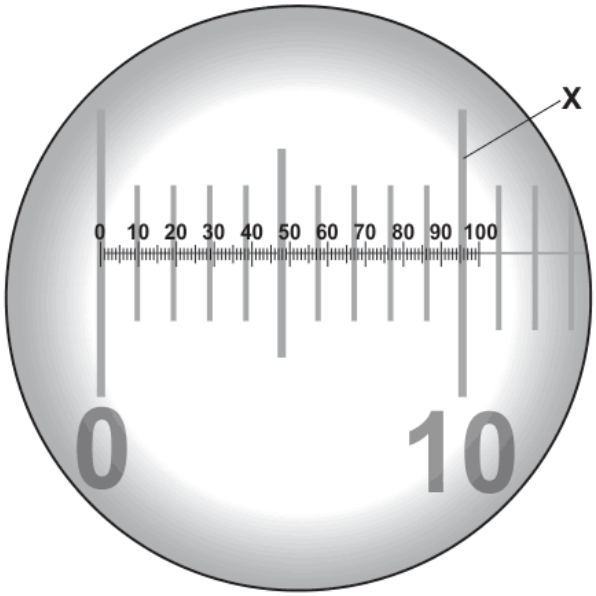
22 questions · 45 marks · about 54 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Component 1 · June 2025 · Q2(b)(i) · 1 mark

(b) A microscope was used to measure the diameter of one of the bacteria shown in **Image 2.1**. The microscope was first calibrated using an eyepiece graticule and a stage micrometer. Divisions marked on the stage micrometer have a constant value of 0.01 mm but the value of one eyepiece unit (epu) varies depending on the magnification of the objective lens.

Image 2.2 shows how a stage micrometer and eyepiece graticule would appear when viewed down a microscope at high magnification.

Image 2.2



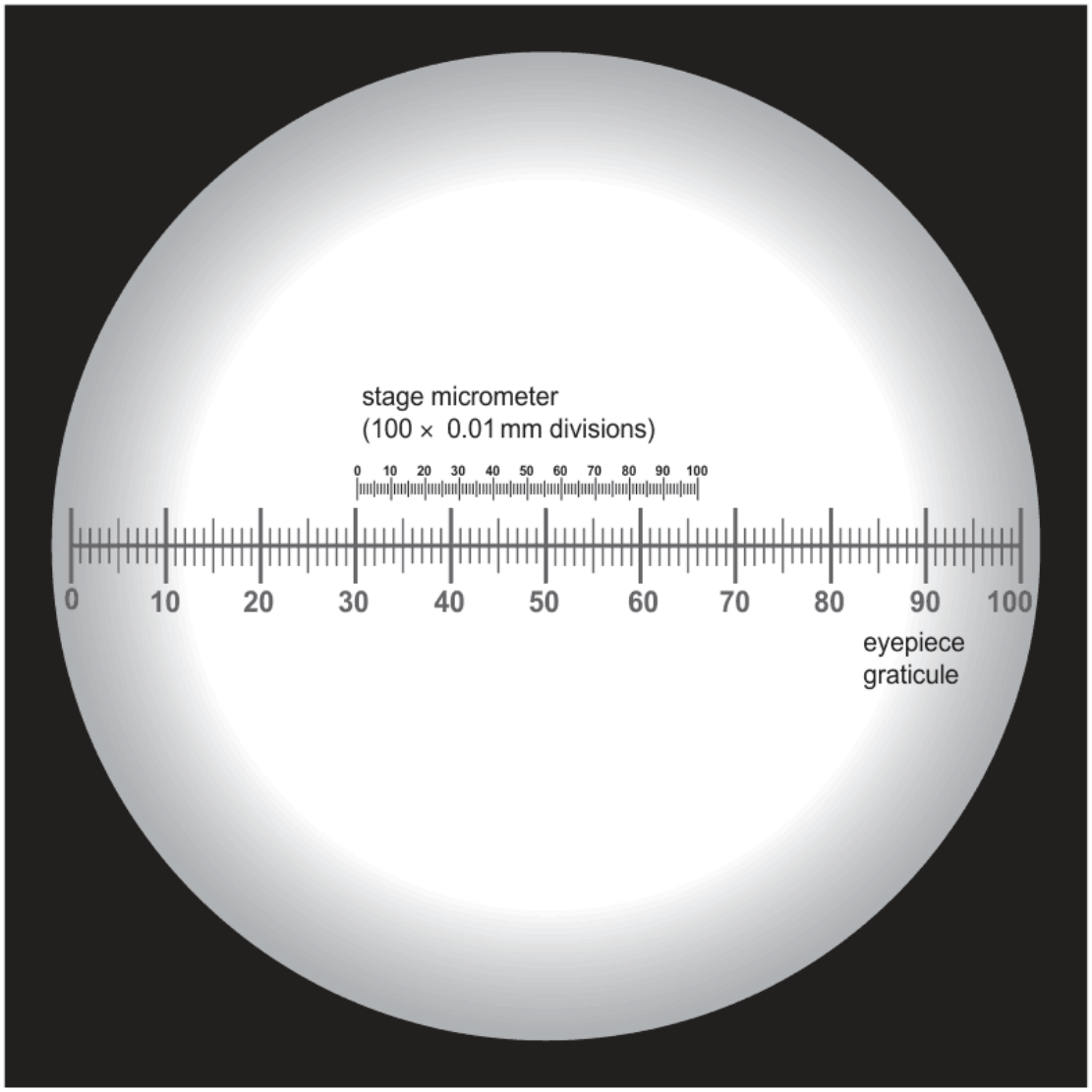
(i) Name scale **X** in **Image 2.2**. [1]

.....

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6. Using a ×4 objective lens, a student calibrated her microscope using the eyepiece graticule and stage micrometer shown in **Image 6.1**.

Image 6.1



(a) (i) Calculate the size of one eyepiece unit (epu) at this magnification. **Give your answer to the nearest micrometre.** [2]
[1 stage micrometer division = 0.01 mm]

1 epu using a ×4 objective lens = ... µm

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Question 3 · A level Component 2 · June 2022 · Q6(a)(ii) · 1 mark

(ii) Explain why the microscope would need to be recalibrated before calculating actual size when using an objective lens of a different magnification. [1]

.....

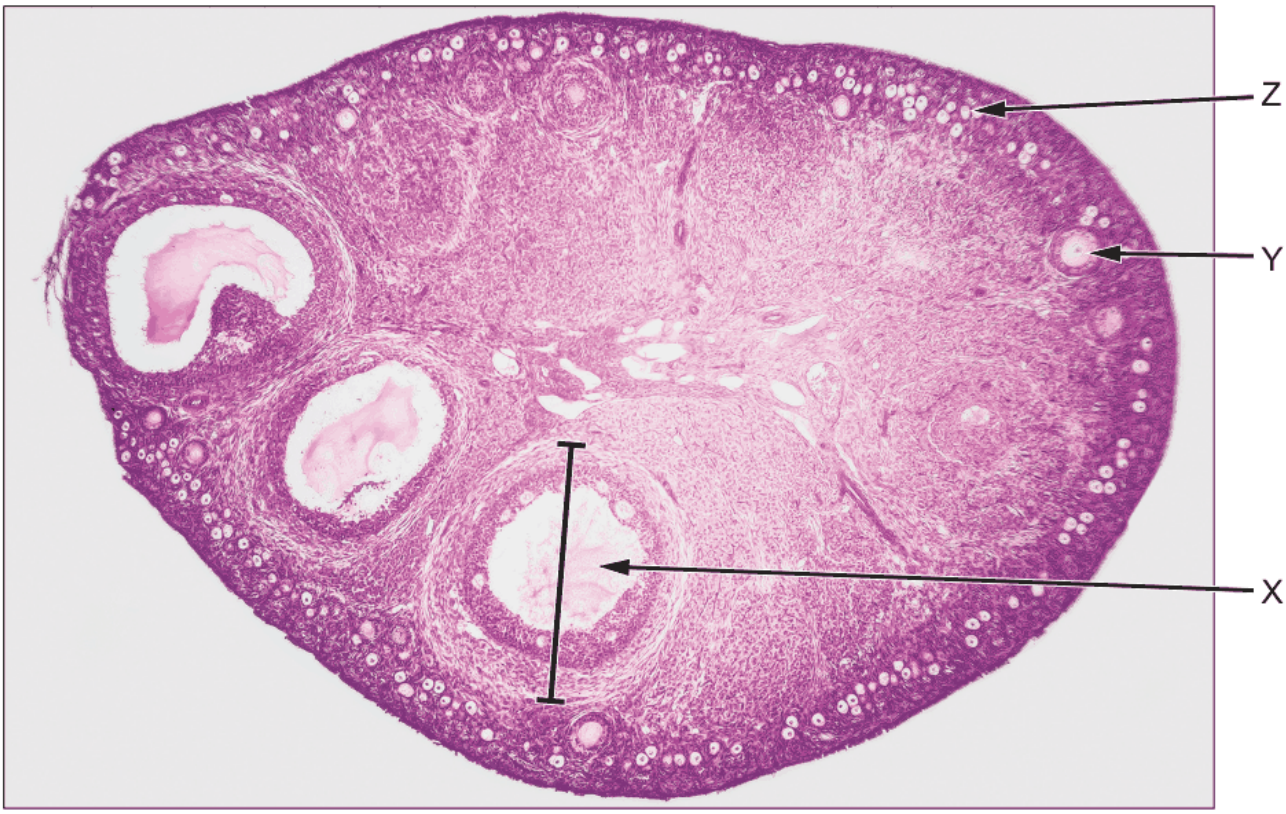
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.....

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Using the same microscope, the student examined a slide of a section through the ovary of a cat as shown in **Image 6.2**.

Image 6.2



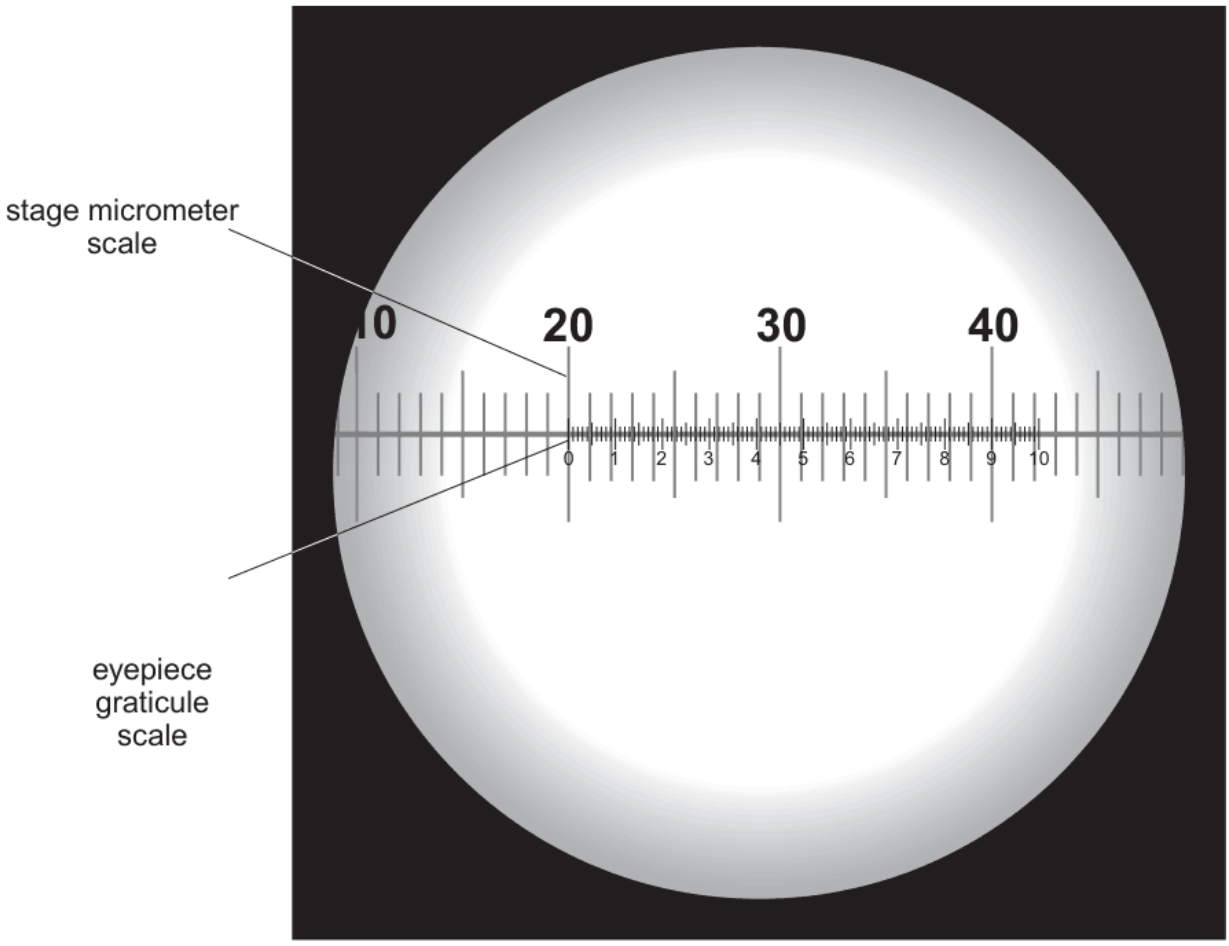
(b) (i) Structure **X** is a mature Graafian follicle with a diameter of 97 epu at the point indicated by the line on the image. Using your calibration of the microscope at this magnification (from (a)(i)), calculate the actual diameter of the Graafian follicle. **Express your answer in mm to 1 decimal place.** [2]

Diameter of Graafian follicle = ... mm

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3. A microscope was calibrated at x100 magnification using an eyepiece graticule and stage micrometer, as shown in the image below.

The eyepiece graticule scale shown in the diagram is divided into 100 units. The section labelled 0 – 1 on the image is equal to 10 eyepiece units.



(a) Use this image to calculate the size of 1 eyepiece unit at this magnification. [2]

1 stage micrometer division = 10 µm

1 eyepiece unit = ... µm

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Question 6 · AS Component 2 · June 2017 · Q3(b)(ii) · 1 mark

(ii) Using the eyepiece graticule, the height of the villus and the thickness of the gut wall were measured at the points indicated. The student recorded the following measurements.

X – X¹ = 20 epu
Y – Y¹ = 25 epu

epu = eye piece unit

Use the answer from *(a)* to calculate the height of the villus marked **X – X¹**. [1]

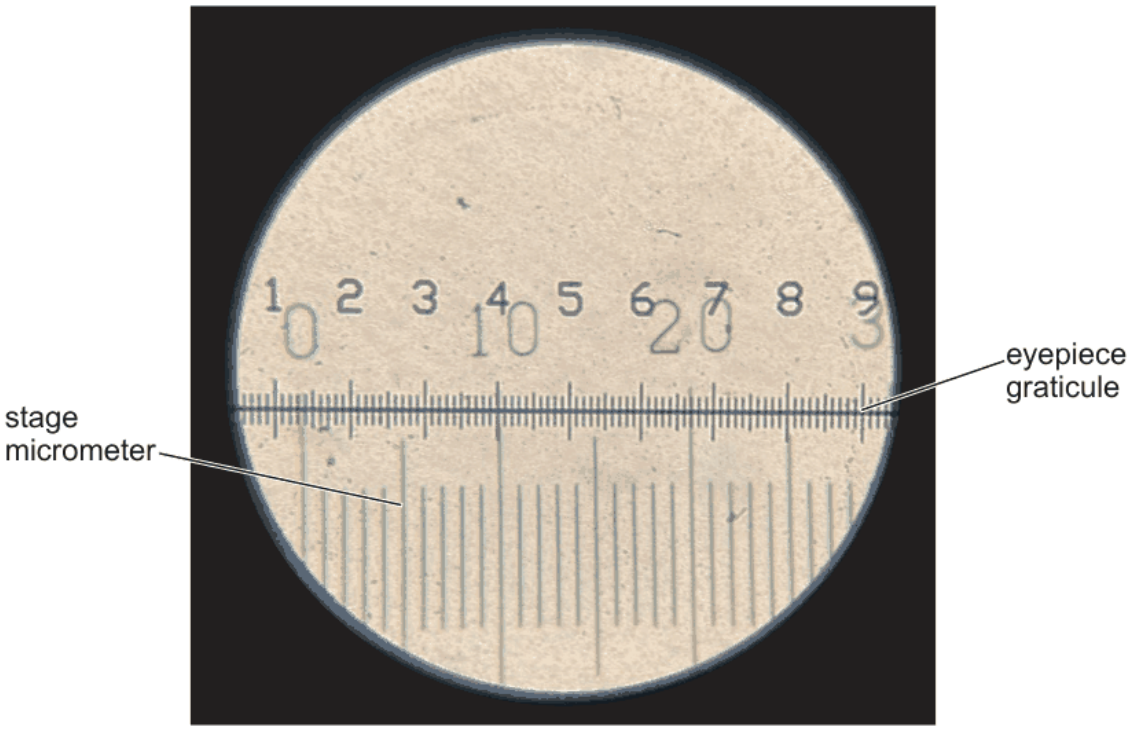
Height of **X – X¹** = ... µm

Questions, mark schemes and examiners' report extracts © WJEC CBAC Ltd (Eduqas).

Question 7 · A level Component 3 · June 2023 · Q1(c)(i) · 2 marks

(c) A stage micrometer can be used to calibrate an eyepiece graticule.
Image 1.2 shows part of a stage micrometer viewed using a ×40 objective.

Image 1.2



(i) Calibrate the microscope using **Image 1.2**
(1 stage micrometer division = 0.01 mm).
Show all your working. Give your answer in µm. [2]

One eyepiece unit = ... µm

Question 8 · AS Component 1 · June 2017 · Q4(a) · 1 mark

4. Chromosomes are not usually visible in cells during most of the cell cycle. However, during mitosis, chromosomes can be observed at different stages of nuclear division.

(a) What must be done to the tissues to enable chromosomes to be seen more clearly? [1]

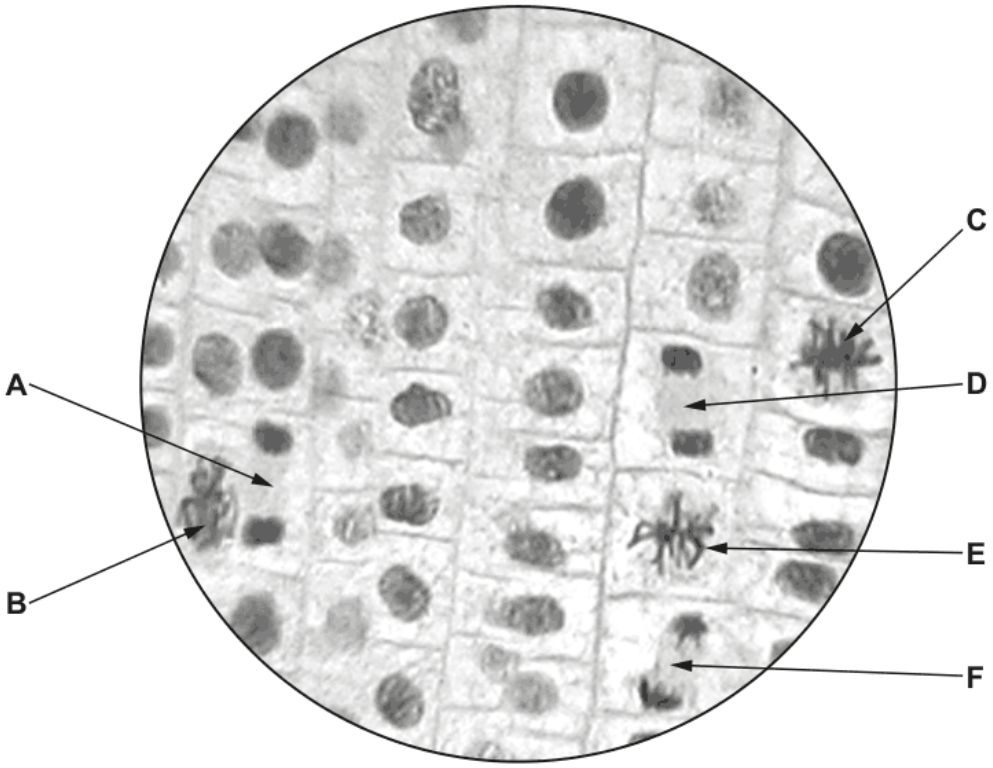
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Question 9 · AS Component 1 · June 2017 · Q4(b) · 3 marks

(b) An investigation was carried out to determine the region of maximum growth in the root tips of garlic *(Allium sativum)*. Longitudinal sections of garlic root tips were examined using a light microscope. The numbers of cells at different stages of mitosis were counted in a field of view at ×400 magnification. The total number of cells in the field of view was also counted. The process was repeated at increasing distances from the root tip.

The image below shows the field of view at 0.2 mm from the root tip.



Using **all** the letters from the image identify the stages of mitosis shown in the image.
[3]

Prophase .....

Metaphase .....

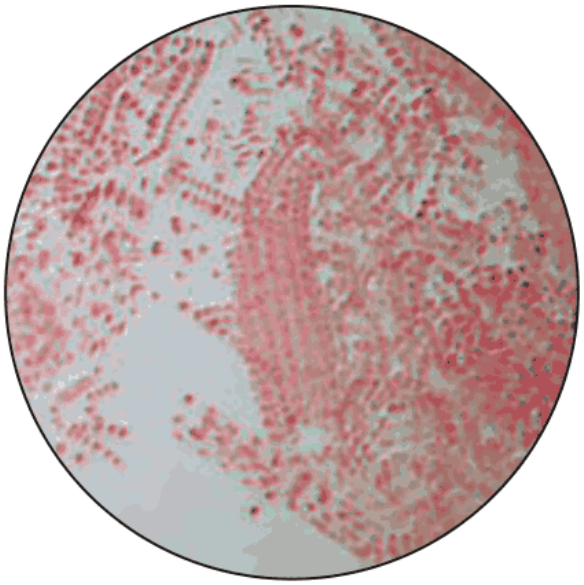
Anaphase .....

Telophase .....

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Question 10 · AS Component 1 · June 2017 · Q4(e) · 3 marks

(e) A student attempted to find the mitotic index of garlic roots using the root tip squash technique in the school laboratory. An image of the slide is shown below.



Using your knowledge of the method used, explain why it would be difficult for the student to calculate a valid mitotic index from the image shown even if a higher magnification was used. [3]

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(b) The mitotic index can be calculated to show the number of cells undergoing mitosis. This can give an estimate of the growth rate at the root tip. The number of cells undergoing mitosis were counted at different distances from the root tip. The results are shown in **Table 2.3**.

Table 2.3

Distance from the root tip / µm	Total number of cells in field of view	Total number of cells in mitosis	Mitotic index / %
200	57	7	12.3
500	49	4	.....
1500	53	1	1.9
2000	54	0	0

(i) Calculate the mitotic index for 500 µm from the root tip. **Write your answer in Table 2.3**. [2]

Space for working

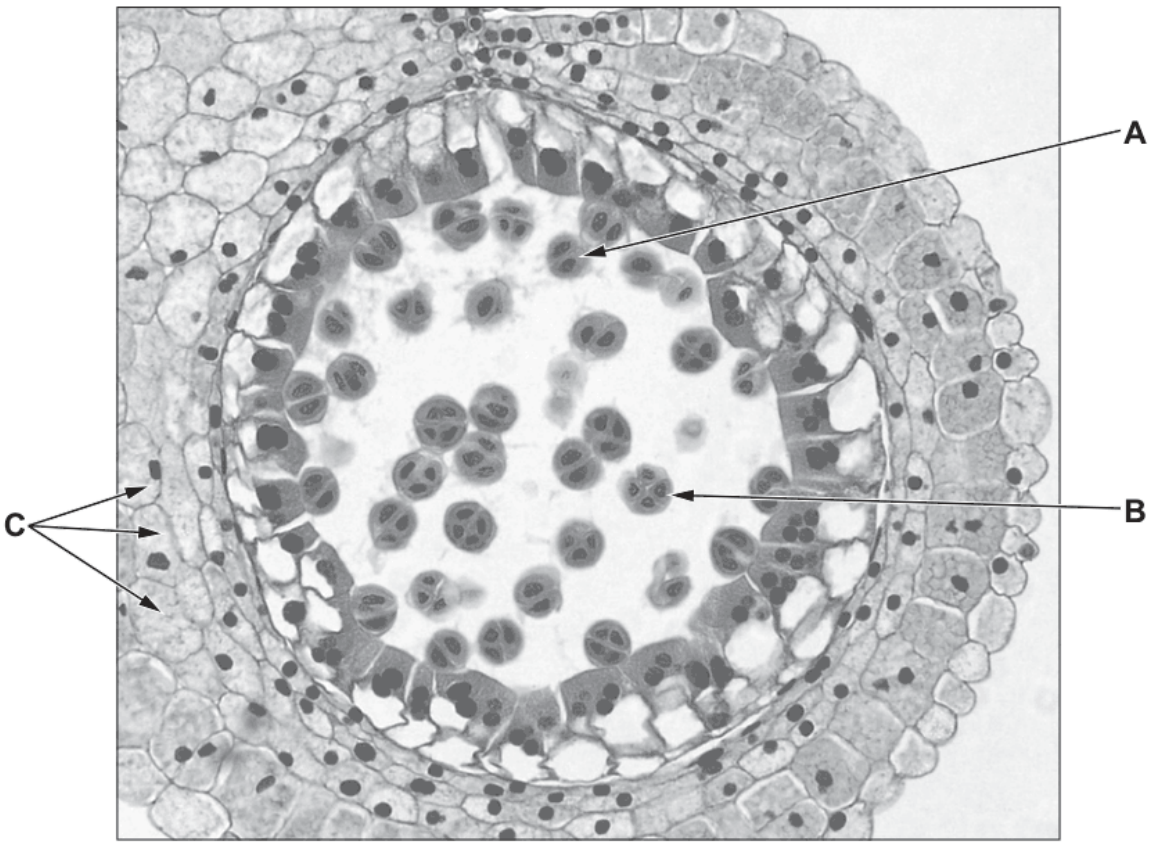
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Question 12 · AS Component 1 · June 2018 · Q1(a)(i) · 1 mark

1. 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]

.....

.....

Question 13 · AS Component 1 · June 2018 · Q1(a)(ii) · 2 marks

(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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Question 14 · A level Component 3 · June 2017 · Q2(a)(i) · 3 marks

2. Tomatoes *(Lycopersicon esculentum)* are an important greenhouse crop. Plant growers need to control conditions in their greenhouses to achieve a high yield of tomato production.

An investigation was carried out to determine the effect of light intensity ($W\,m^{-2}$) on the density of stomata in the leaves of tomato plants.

(a) (i) Outline a method by which the density of stomata could have been determined.

[3]

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Question 15 · A level Component 3 · June 2022 · Q5(a)(i) · 3 marks

5. A student investigated the number of stomata on the lower epidermis of a leaf. **Image 5.1** shows a small area of the lower epidermis of the leaf at a magnification of ×100.

Image 5.1



(a) (i) The student counted **9** stomata in this field of view.

The diameter of the field of view is 0.18 mm.

Using this information, calculate the number of stomata per mm^2.

Express your answer to the nearest whole figure.

Area of field of view=πr^2 [3]

π = 3.14

Number of stomata / mm^2 = ...

Question 16 · A level Component 3 · June 2022 · Q5(a)(ii) · 2 marks

(ii) State **two** ways in which the student could improve their confidence in the results. [2]

.....

.....

.....

.....

.....

.....

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3. (a) Stomata on the surface of leaves are the main site of gas exchange in plants.

Stomatal density can be measured by applying nail varnish to the under-surface of the leaf to create an impression of the leaf surface. **Image 3.1** shows an impression of part of the leaf surface of a mesophyte leaf measuring 0.2 mm × 0.2 mm.

Image 3.1



(i) Using a light microscope, **21** stomata were counted in the area. Use this number to calculate the number of stomata per mm^2. [2]

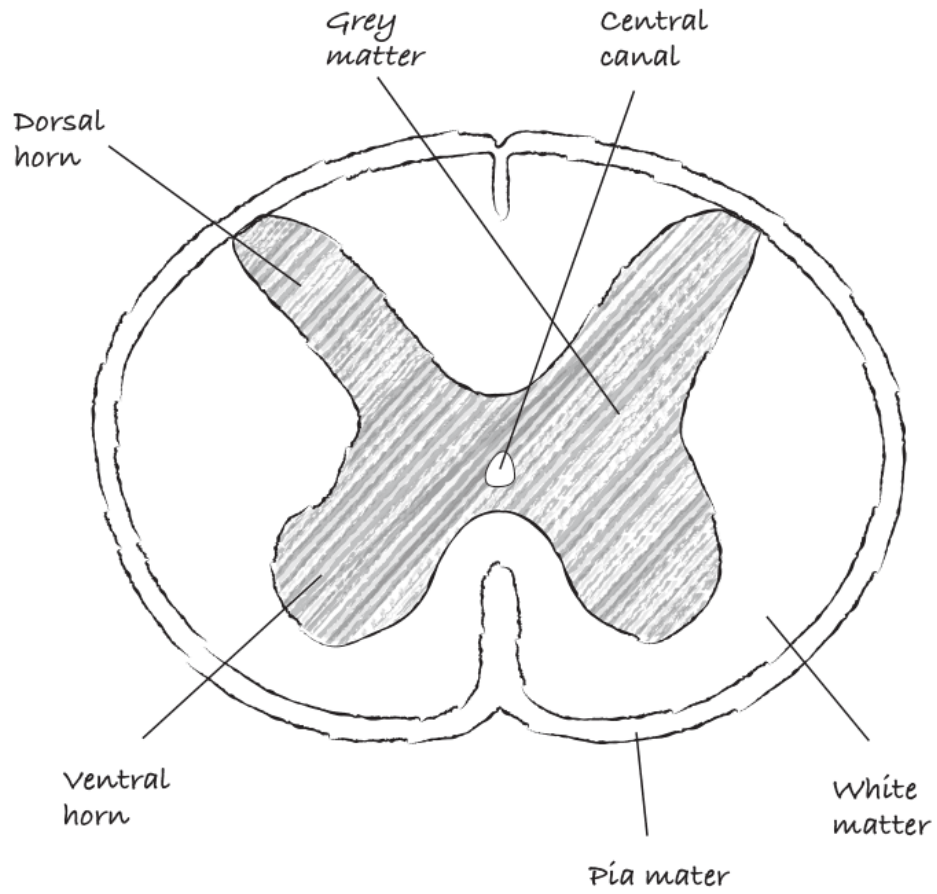
Number of stomata = ... per mm^2

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(d) A student viewed a cross section of a spinal cord down a microscope. He drew a low power plan using a sharp pencil and used a text book to label the structures he observed.

His low power plan is shown in **image 4.3**.

Image 4.3

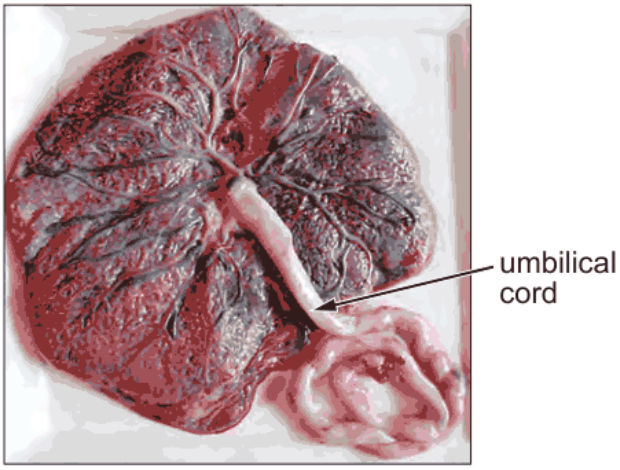


(i) If this student were to draw a low power plan of a leaf or artery in the future, suggest **three** guidelines for the student to follow to ensure they present their diagrams correctly. [3]

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5. Figure 5.1 shows a placenta at full term and a transverse section through the umbilical cord.

Figure 5.1



Placenta



T.S. umbilical cord

(a) Name structures **A** and **B** in Figure 5.1 and give details of the features that allowed you to identify each one. [4]

Structure	Name	Features
A		
B		

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Question 20 · AS Component 2 · June 2022 · Q4(a)(i) · 2 marks

4. (a) The head of a bony fish was dissected to remove its gills as shown in **Image 4.1**.

Image 4.1



(i) Complete the risk assessment below for the **main** hazard in the fish head dissection. [2]

Hazard	Risk	Control measure
.....	.....	.....
.....	.....	.....
.....	.....	.....

Question 21 · AS Component 2 · June 2019 · Q1(d) · 1 mark

(d) State **one** ethical issue which should be considered when using animals for dissection. [1]

.....

.....

.....

.....

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4. **Image 4.1** shows a kidney that has been dissected using a scalpel.

Image 4.1



(a) Complete the risk assessment below for **one** hazard involved in this dissection. [2]

Hazard	Risk	Control measure
.....	.....	.....
.....	.....	.....

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Mark schemes

Question 1 · A level Component 1 · June 2025 · Q2(b)(i) · 1 mark

	(b)	(i)		Stage micrometer (1)	1		1	1

Question 2 · A level Component 2 · June 2022 · Q6(a)(i) · 2 marks

6	(a)	(i)	1 epu = 28µm (2 marks) Award 1 mark: 27.77 / 27.78 1 epu = 100smd /36 epu x 0.01mm Accept any correct matches between epus and smds	2	2	2	2

Question 3 · A level Component 2 · June 2022 · Q6(a)(ii) · 1 mark

(ii)	Eyepiece graticule is a fixed scale but values of 1 epu differ at different magnification / number of smd per epu will change (at different magnifications) / stage micrometer appears to have different sizes at different magnifications (but value of 1 smd is fixed) (1) OWTTE	1	1	1

Question 4 · A level Component 2 · June 2022 · Q6(b)(i) · 2 marks

(b)	(i)	2.7mm (2 marks) Award 1 mark for: 2.716mm (1) 2716 / 1000 or 97epu x 28µm (1) NOTE: if answer is wrong and cannot award 1 mark incorrect rounding, scroll up to check their answer to (a) (i) and allow ecf for correct answer – 2 marks to 1 dp, 1 mark to >1dp or sight of correct working	2	2	2	2

Question 5 · AS Component 2 · June 2017 · Q3(a) · 2 marks

3	(a)	1 epu= 200/90 = 2.2 µm = 2 marks (ignore additional decimal places) 90 epu = 20 smd / 45 epu = 10 smd for 1 mark Allow 22.2/ 22 for 1 mark (incorrect reading from scale)	2	2	2	2

Question 6 · AS Component 2 · June 2017 · Q3(b)(ii) · 1 mark

(ii)	20 x 2.2 = 44 µm (1) Accept 440/444 (ECF)	1	1	1

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Question 7 · A level Component 3 · June 2023 · Q1(c)(i) · 2 marks

(c)	(i)		1epu = 3.7(037037) µm = 2 marks accept correct rounding (Accept range from 3.3-3.8 for 2 marks) If incorrect award one mark for 0.0037(mm) 0.00375 (mm) 0.0038 (mm) 0.003 (mm) 1 epu = 10/27 or 15/40 or 5/13 or 1/3 0.37 x 0.01

2	2	2	2

Question 8 · AS Component 1 · June 2017 · Q4(a) · 1 mark

4	(a)		Staining/ add a dye/ add correct named dye	1		1	1

Question 9 · AS Component 1 · June 2017 · Q4(b) · 3 marks

(b)		**Prophase** B **Metaphase** C **and** E **Anaphase** F **Telophase** A **and** D 6 correct answers = 3 marks 4/5 correct answers = 2 marks 2/3 correct answers = 1 mark 0/1 correct answers = 0 marks	3		3	3

Question 10 · AS Component 1 · June 2017 · Q4(e) · 3 marks

(e)	**Any three (x1) from:** • cells may be damaged/ broken(1) NOT squashed • not stained enough (to see chromosomes)/ chromosomes not visible/ blurred image/ poor resolution (1) • layers of cells overlap (1) • {non-random selection of /lack of consistency in how part cells are included in} fields of view (1)	3	3	3

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Question 11 · AS Component 1 · June 2023 · Q2(b)(i) · 2 marks

(b)	(i)	8.2 (2 marks) If incorrect award 1 mark for 4/49 x 100 8.16 not rounded	2	2	2	2

Question 12 · AS Component 1 · June 2018 · Q1(a)(i) · 1 mark

1	(a)	(i)		{A has/meiosis I results in} two {cells/nuclei} and {B has/ meiosis II results in} 4 / A results from one division and B results from two divisions (1)		1	1	1

Question 13 · AS Component 1 · June 2018 · Q1(a)(ii) · 2 marks

		(ii)		plane/angle of section of through cell may not include a nucleus (1) (where nucleus visible) may have been cut at different {levels/planes} (1)

1	1	2	2

Question 14 · A level Component 3 · June 2017 · Q2(a)(i) · 3 marks

2	(a)	(i)	coat surface of leaf with clear nail varnish (several times)/ PVA/ sellotape/ Any valid alternative method (1) examine using a (light) microscope (1) count number of stomata in {the field of view / known area} (1)	3	3	3

Question 15 · A level Component 3 · June 2022 · Q5(a)(i) · 3 marks

5	(a)	(i)	351/353/354= 3 marks Accept 360 (if rounded area to 0.025) **Award 2 marks** 9/0.025434 9/0.025 353.8…… 88/ 89 (used diameter instead of radius) 300 (rounded area to 0.03) **Award 1 mark for** Area = 3.14x 0.09^2 = 0.025(434) mm^2 88.46 (used diameter instead of radius and not rounded) 9/0.03	3	3	3	3

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Question 16 · A level Component 3 · June 2022 · Q5(a)(ii) · 2 marks

(ii)	**Any two (x1) from** Use several {counts/fields of view/ areas of leaf}/ repeat and calculate a mean (1) Some method of discounting half a stoma in a field of view/ owtte (1) Make sure each is only counted once (1)	2	2	2	

Question 17 · AS Component 2 · June 2022 · Q3(a)(i) · 2 marks

3	(a)	(i)		525 = 2 marks If incorrect award 1 mark for 21/0.04 21/ (0.2 x 0.2) 20/0.04	2	2	2

Question 18 · A level Component 3 · Autumn 2021 · Q4(d)(i) · 3 marks

(d)	(i)	**Any three (x1) from:** Do not shade (1) Do not cross label lines (1) Do not use sketch lines (1) Add magnification or scale bar (1) Show tissue layers not individual cells (1)	3	3	3

Question 19 · A level Component 2 · June 2019 · Q5(a) · 4 marks

5	*(a)*	A- vein (1) {thin} (smooth) muscle layer/ large lumen (1) B-artery (1) Thick (smooth) muscle layer/ small lumen (1)	2 2		2 4	

Question 20 · AS Component 2 · June 2022 · Q4(a)(i) · 2 marks

4	(a)	(i)	Hazard: {Dissecting instruments / scalpel} are <u>sharp</u> (1)	Risk: The skin could be cut or pierced when scalpel being used	Control measure: Cut onto white tile/ cut away from body (1)				
			1 mark for hazard 1 mark for risk + control measure (must match)						

	2		2		2

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Question 21 · AS Component 2 · June 2019 · Q1(d) · 1 mark

(d)	Ensure animals are treated humanely / Ensure no animals killed needlessly	1	1		

Question 22 · A level Component 3 · June 2022 · Q4(a) · 2 marks

4 (a)

Hazard	Risk	Control measure
{Instruments/ scalpel} are sharp	Cut hand when dissecting	Care when cutting/ Cut away/ down onto tile/hard surface
Bacteria are a biohazard	Risk of infection from handling	Disinfect bench/ any equipment used Cover cuts/ Wear gloves/ wash hands

1 mark for hazard
1 mark for risk and associated control measure

2 2 2

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