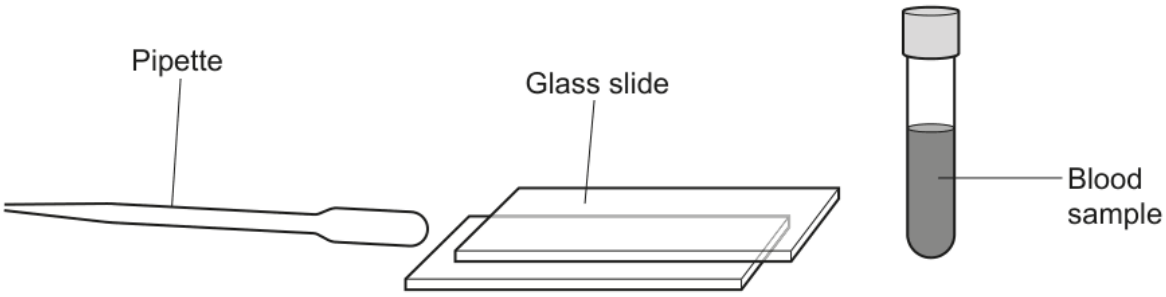
PAG 1 Microscopy: OCR A Level Biology Exam Questions by Topic

17 questions · 43 marks · about 52 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 2 · June 2024 · Q17(a) · 3 marks

17 Blood cells can be examined using microscopy.

(a) This is some equipment that could be used when preparing a blood smear.



Describe how to use the equipment to prepare a blood smear that could then be stained and viewed under a microscope.

.....

.....

.....

.....

.....

..... **[3]**

Turn over

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

Question 2 · A level Paper 3 · June 2019 · Q1(a)(iv) · 2 marks

(iv) The student stained a sago pondweed sample to improve the contrast between cellular components when viewed under a microscope.

The student used the following procedure to stain the sample:

- Use forceps to place the sample on a glass slide.
- Use a pipette to place two drops of the stain in the centre of the sample.
- Carefully lower a cover slip onto the sample, ensuring that the cover slip is parallel with the slide as it is lowered.

Describe **two** improvements the student should make to their staining procedure.

1 .....

.....

2 .....

.....

[2]

Question 3 · A level Paper 1 · June 2023 · Q21(a)(iii) · 2 marks

(iii) The scientists found that the dye moved both up and down the stems.

A student wanted to investigate this in the laboratory. They devised an experiment using water-soluble food dyes injected into the stems of sunflower plants growing in pots.

Suggest how they could observe the route taken by the dyes.

.....

.....

.....

.....

..... **[2]**

Turn over

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

Question 4 · AS Paper 2 · June 2024 · Q5(a)(i) · 2 marks

5

(a)

(i) Some students collect a sample of pond water to observe under a light microscope.

They pour some of the pond water onto a microscope slide.

Describe how they could improve their technique in preparing the microscope slide for examination under a light microscope.

.....

.....

.....

.....

..... **[2]**

Question 5 · A level Paper 1 · November 2020 · Q20(c)(ii) · 2 marks

(ii) A light microscope can be used to observe yeast cells.

State the equipment that would be needed, in addition to a microscope, to measure the average diameter of yeast cells.

.....

..... **[2]**

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

Question 6 · AS Paper 1 · June 2018 · Q25(b) · 3 marks

(b) Leaf hair density can be measured in the laboratory.

Outline a practical method that could be used to determine the density of hairs on the underside of a leaf.

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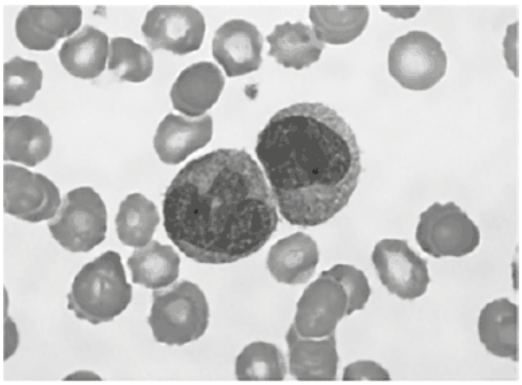
..... **[3]**

Turn over

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

Question 7 · AS Paper 1 · November 2021 · Q22(a) · 4 marks

22 The image below shows two white blood cells in a blood sample, seen using a light microscope.



(a) Explain how to measure the diameter of the nucleus of one of the white blood cells, when observing the cells through a light microscope.

.....

.....

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.....

.....

.....

.....

.....

.....

..... **[4]**

Question 8 · AS Paper 2 · June 2024 · Q5(a)(ii) · 2 marks

(ii) Explain how the students would use the different objective lenses of a light microscope to focus and observe the pond water sample at high power magnification.

.....

.....

.....

.....

..... **[2]**

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

Question 9 · AS Paper 1 · June 2025 · Q26(b) · 2 marks

(b) A student is studying erythrocytes and neutrophils in a blood sample.

They smear a drop of the blood sample across a microscope slide and place it under a light microscope.

They focus the microscope using a high power but cannot see any white blood cells.

Suggest **and** explain why the student cannot see any white blood cells on the slide.

.....

.....

.....

.....

..... **[2]**

Question 10 · A level Paper 3 · June 2022 · Q2(c) · 2 marks

(c) Differential staining can be used to distinguish between bacteria with thick cell walls and bacteria with thin cell walls.

Four substances are used when differentially staining bacteria:

- Crystal violet, which stains bacteria purple.
- Safranin, which stains bacteria pink but is not visible in the presence of crystal violet.
- Alcohol, which removes fixed stains from bacteria with thin cell walls.
- Iodide solution, which fixes crystal violet to bacterial cells.

Suggest a practical procedure for staining a slide that would allow thin-walled bacteria to be differentiated from thick-walled bacteria.

.....

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.....

..... **[2]**

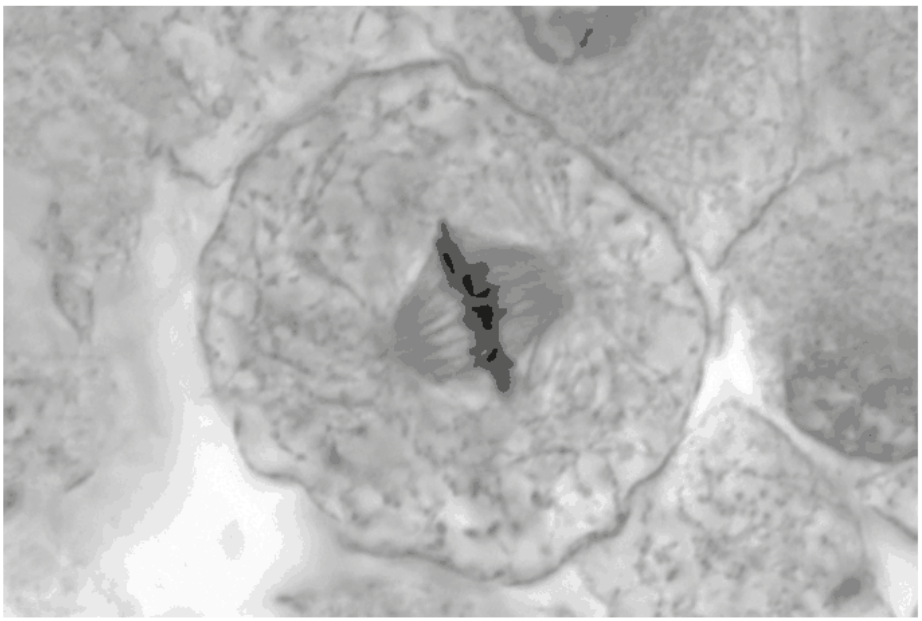
Turn over

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

Question 11 · information from earlier in the question

16 Microscopy can be used to examine the structure of stem cells.

(a) The image shows a stem cell from a fish embryo viewed under a light microscope.



×2000

(i) Identify **two** pieces of evidence that suggest that the image was produced by a light microscope rather than a scanning electron microscope.

1 .....

.....

2 .....

.....

[2]

Question 11 · A level Paper 2 · June 2025 · Q16(a)(iii) · 2 marks

(iii) Explain why staining is useful in microscopy.

Use structures visible in the image to support your answer.

.....

.....

.....

.....

..... **[2]**

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

1 (a) A student was observing onion epithelial cells using a light microscope. They photographed these cells and the image obtained is shown in Fig. 1.1. The student then made a drawing of a few cells from this image. The drawing is shown in Fig. 1.2.

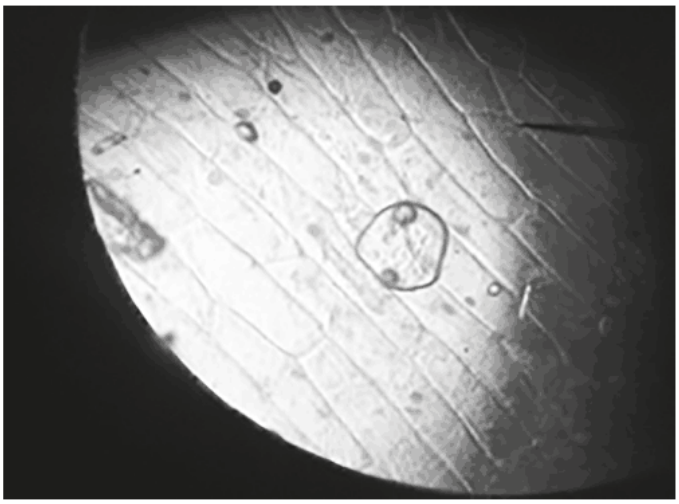


Fig. 1.1

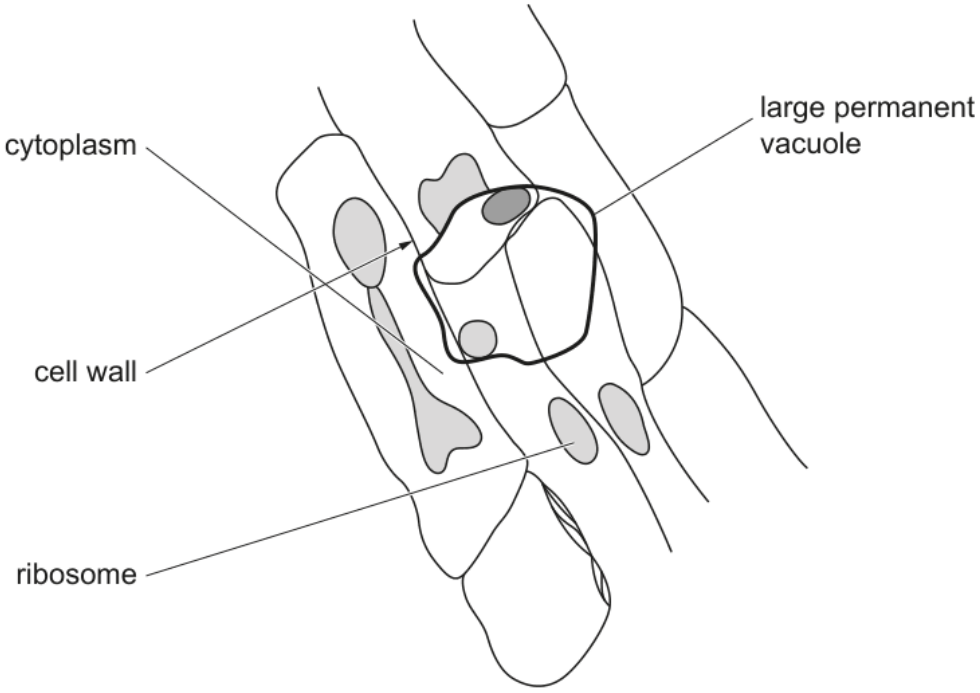


Fig. 1.2

The teacher stated that two of the labels on the drawing Fig. 1.2 were incorrect, and also that it was a poor quality biological drawing.

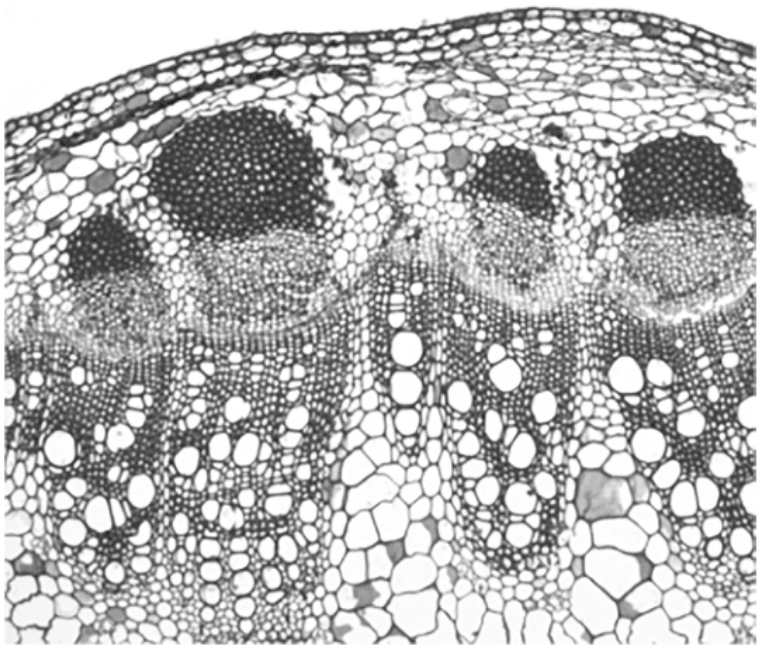
(i) Identify **one** incorrect label and explain your answer.

incorrect label .....

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

Question 13 · information from earlier in the question

(b) The photomicrograph is of a transverse section of a stem of a sunflower, *Helianthus annuus*.



(i) **On the photomicrograph**, label the location of meristem tissue. **[2]**

Question 13 · AS Paper 1 · June 2022 · Q25(b)(ii) · 3 marks

(ii) Name the type of microscope used to produce the photomicrograph **and** explain the reasons for your choice.

Name of microscope .....

Reasons for your choice .....

.....

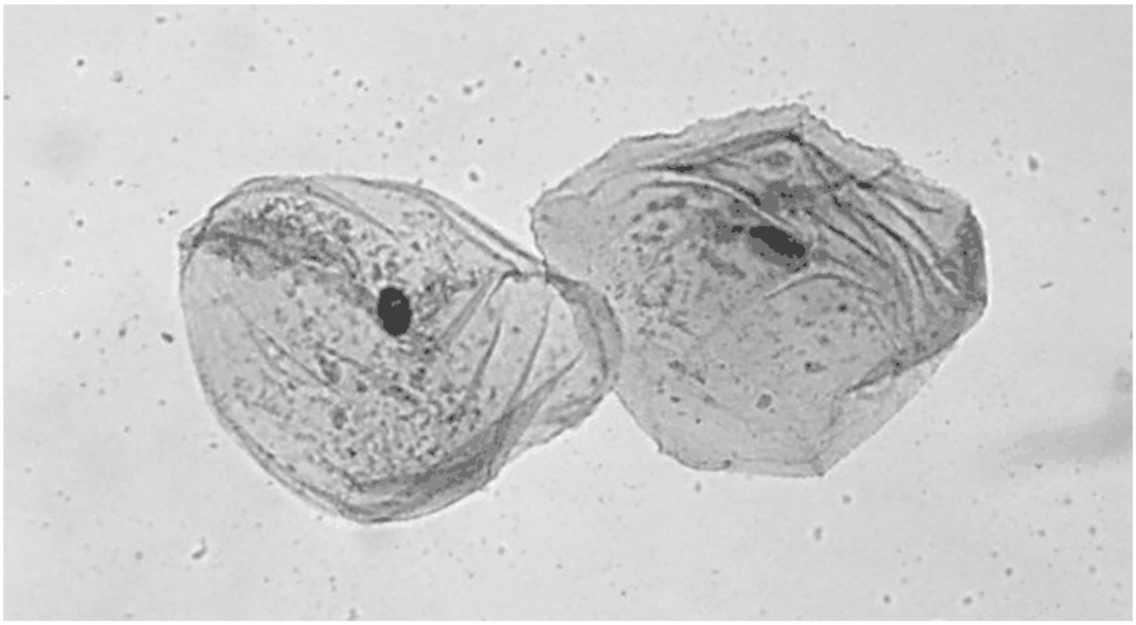
.....

..... **[3]**

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

(b) **Fig. 5.1** shows a photomicrograph of human cheek cells observed by the students under a light microscope.

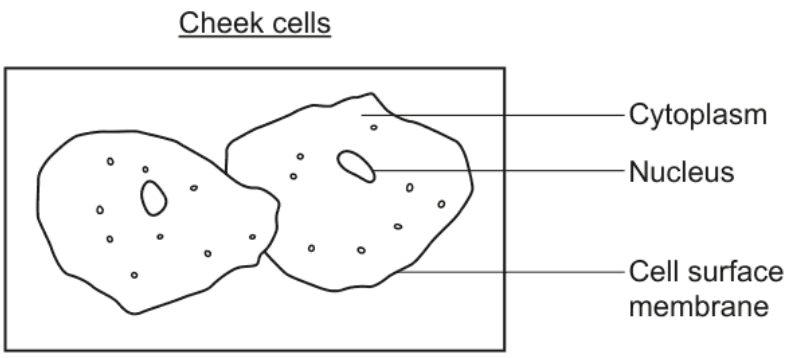
Fig. 5.1



Magnification ×400

Fig. 5.2 shows a drawing made by a student of the cells from this photomicrograph.

Fig. 5.2



Magnification ×400

A student said **Fig. 5.2** was a correct biological drawing.

Identify **two** pieces of evidence from **Fig. 5.1** and **Fig. 5.2** that support the student's comment.

1 .....

.....

.....

2 .....

.....

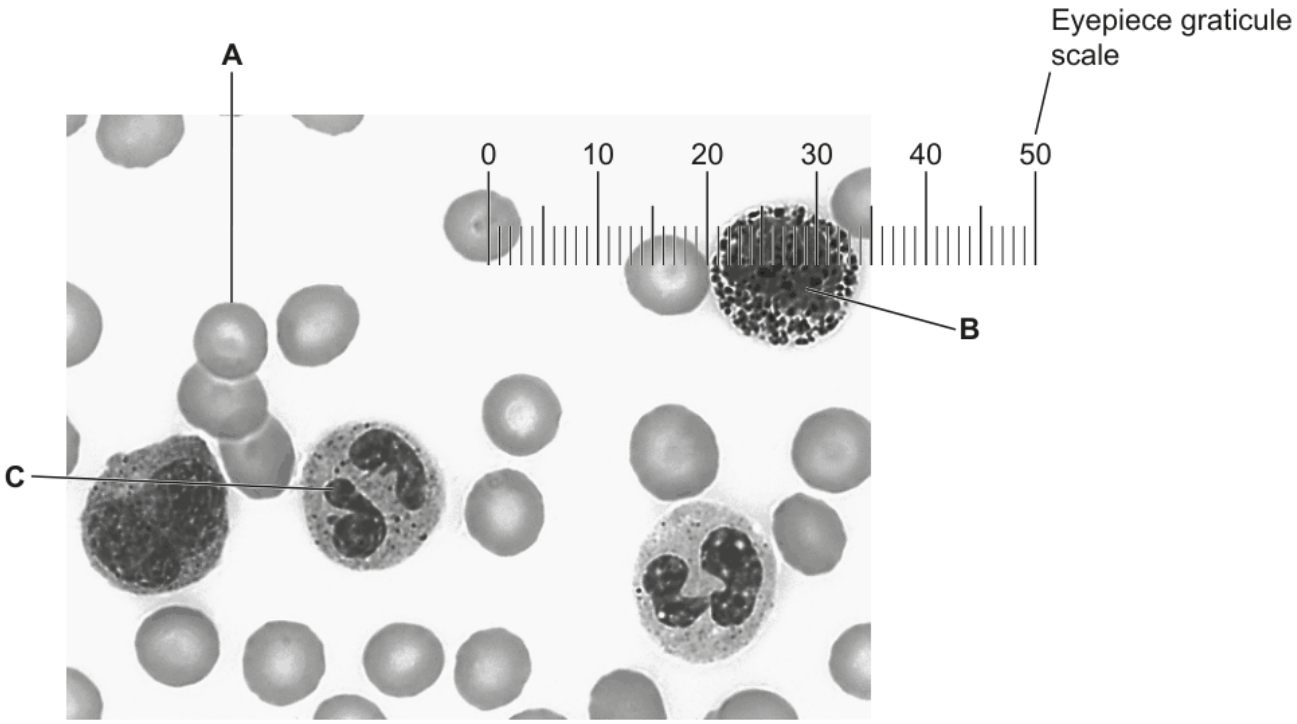
.....

[2]

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Question 15 · information from earlier in the question

(b) This is a light micrograph of a human blood smear.



(i) The cell labelled **A** is sometimes known as a red blood cell.

Name cell **A**.

..... **[1]**

Question 15 · A level Paper 2 · June 2024 · Q17(b)(ii) · 4 marks

(ii) In the space below, draw a labelled diagram of cell **C**.

[4]

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(iii) Fig. 1.2 shows a student's drawing of another sago pondweed cell, which was observed under a light microscope. The student used a sharp pencil but did not label the drawing.

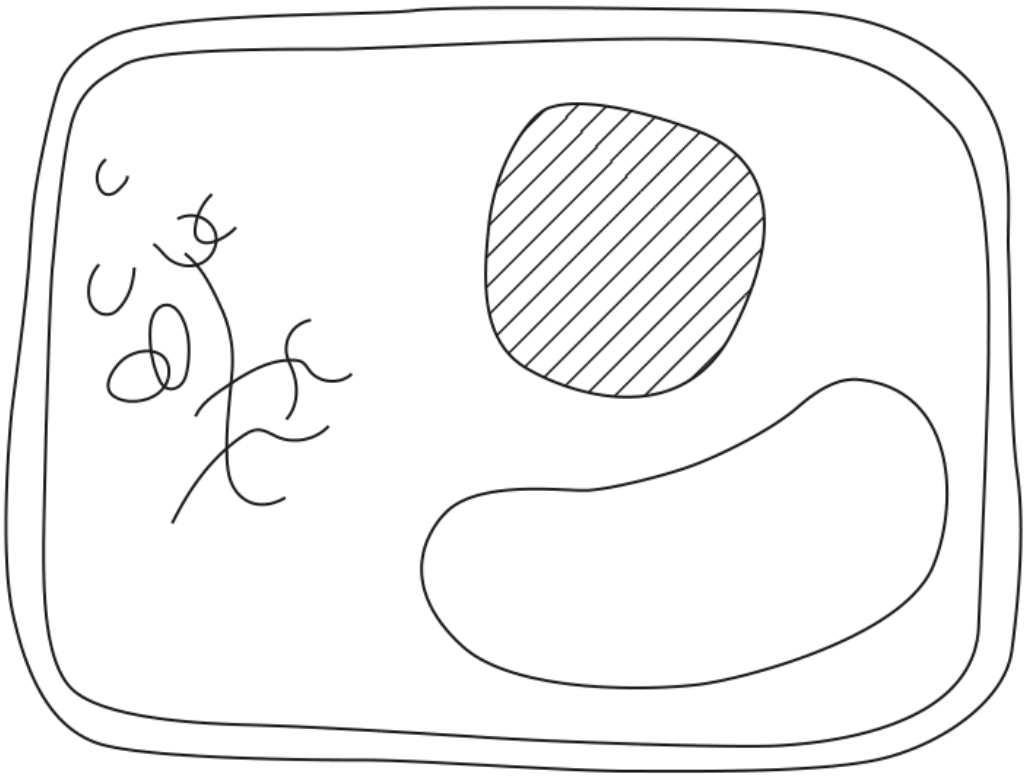


Fig. 1.2

Describe **two other** ways in which the drawing could be improved.

.....

.....

.....

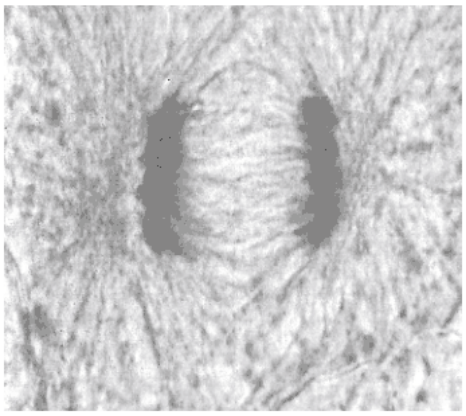
..... **[2]**

Turn over

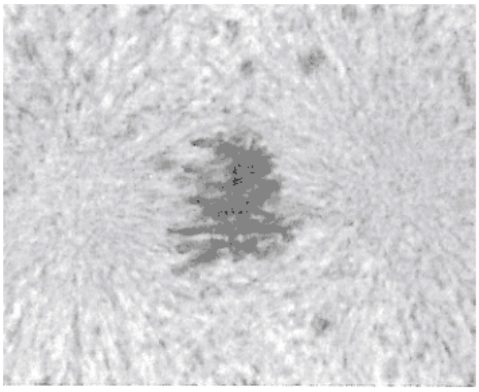
Questions, mark schemes and examiners' report extracts © OCR.

Question 17 · information from earlier in the question

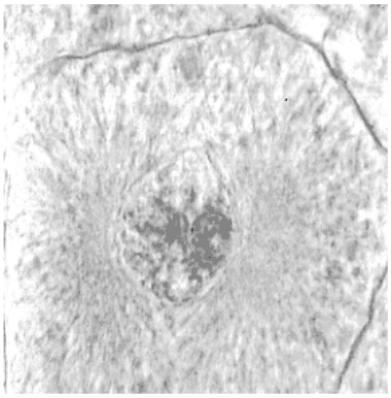
23 The photomicrographs shown in Fig. 23 below are taken from an animal cell undergoing mitosis.



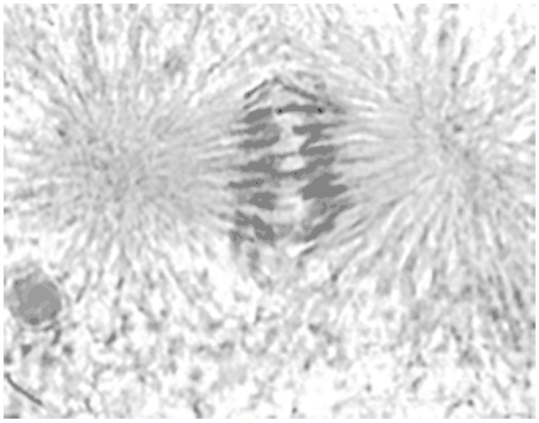
P



Q



R



S

Fig. 23

(a) (i) Write the letters of the images, **P** to **S**, in the correct mitotic sequence.

.... **[1]**

Question 17 · AS Paper 1 · June 2019 · Q23(b) · 3 marks

(b) In the space below produce a **labelled** diagram of the cell in image **S** from Fig. 23.

[3]

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

Mark schemes

Question 1 · A level Paper 2 · June 2024 · Q17(a) · 3 marks

17	**(a)**		**3 max**	**1.2 x 1** **3.3 x 2**	**CREDIT** answers from an annotated diagram **IGNORE** staining
			1 use pipette to place blood on slide ✓			
			2 (place blood) near one end (of slide) ✓			
			3 use (2nd) slide / cover slip , to spread / AW , blood across slide ✓			**3 ALLOW** smear as AW for spread
			4 slide / cover slip , at an angle ✓			
			5 AVP ✓			**5 CREDIT** allow to (air) dry

Question 2 · A level Paper 3 · June 2019 · Q1(a)(iv) · 2 marks

iv	place stain at edge of sample (not the centre) ✓ lower cover slip at an angle / use mounted needle ✓ use blotting paper to, remove excess stain / pull stain through ✓ use more than one stain (to improve contrast) ✓

2 max	**Mark as prose** **IGNORE** use forceps / lay sample flat **ALLOW** place stain at side of sample **ALLOW** stated angles given e.g. 45° **ALLOW** 'tissue/paper towel' instead of 'blotting paper' **ALLOW** ensure stain covers whole sample

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Question 3 · A level Paper 1 · June 2023 · Q21(a)(iii) · 2 marks

21	(a)	(iii)	*idea of* cutting a series of sections at intervals along stem ✓ transverse / longitudinal , section(s) ✓ *idea of taking* from above **and** below the site of injection ✓ (view sections) using a microscope ✓	**max 2**	3.3

ALLOW e.g. cut several sections , at intervals / along the stem

ALLOW cross section for transverse

ALLOW see if dye visibly appears in leaves / flowers / stem

Question 4 · AS Paper 2 · June 2024 · Q5(a)(i) · 2 marks

5	(a)	(i)	**1** use, dropper / pipette (to remove sample of pondwater) to place a, small amount / drop / droplet, onto slide ✓ **2** place coverslip , over the sample / on the slide ✓ **3** ensuring there are no air bubbles ✓

max 2	**IGNORE** ref to smearing the water sample / staining the sample **1 DO NOT ALLOW** few drops (added to slide)

Question 5 · A level Paper 1 · November 2020 · Q20(c)(ii) · 2 marks

(ii)	eyepiece graticule ✓ stage micrometer ✓	**2**	2.3	**IGNORE** haemocytometer

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Question 6 · AS Paper 1 · June 2018 · Q25(b) · 3 marks

(b)		use a microscope ✓ use a graticule / calibrate ✓ count number hairs per (unit) area ✓ repeat (measurements on same leaf) ✓ calculate mean (leaf hair density) ✓ divide by area used (to calculate density) ✓

3 max	e.g. calculate the area of view **ALLOW** calculate mean average

Question 7 · AS Paper 1 · November 2021 · Q22(a) · 4 marks

22	**(a)**	use eyepiece graticule ✓ calibrate graticule, using stage micrometer / detail of calibration / calculate the length of one epu ✓ measure the diameter of the nucleus in, epu / graticule units ✓ take repeat measurements **and** calculate a mean diameter (in epu) ✓ use calibrated epu to calculate diameter (of nucleus) (in µm) / described ✓

4 max	e.g. of detail: align two scales and record number of divisions per graticule unit

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Question 8 · AS Paper 2 · June 2024 · Q5(a)(ii) · 2 marks

(ii)	**1** select low power lens then higher power ✓	**max 2**
	2 use coarse focus to find, correct field of view / object ✓	
	3 use fine focus for clear(er) image ✓	
	4 *ref to* x4 / x10 / x40 (lens power / magnification) ✓	

1 ALLOW magnification for 'power'

2 ALLOW adjustment for 'focus'
2 IGNORE ref to fine focus for finding correct field of view

3 IGNORE ref to coarse focus for getting a clear image

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Question 9 · AS Paper 1 · June 2025 · Q26(b) · 2 marks

(b)	*Suggest 1* (student) had not added stain(s) / not visible unless stained / stain should have been added AW ✓ *Explain 2* *idea that* staining increases contrast (to make white blood cells visible) ✓ **OR** *Suggest 2* *idea that* no white blood cells in field of view ✓ *Explain 2* (due to) small number of white blood cells in blood smear **OR** *idea of* proportionally less white blood cells lowering chances of seeing one✓

2 max	3.3 3.4	**ALLOW** examples of relevant named stains: haemtoxylin , Eosin , HE , Giemsa, Pappenheim, hematoxylin-eosin, methylene blue, tetrachrome. **ALLOW** dye/s in place of stain **ALLOW** ORA e.g. some parts of the cell will appear darker than others e.g. field of view is too small to see any WBCs e.g. if the person does not have an infection there will be less / few WBCs **DO NOT ALLOW** no white blood cells in blood **IGNORE** ref to ill/ness / sick/ness unqualified

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

Question 10 · A level Paper 3 · June 2022 · Q2(c) · 2 marks

2	(c)	*step 1 add crystal violet* *step 2 add iodide solution* *step 3 add alcohol / ethanol* *step 4 add safranin* All steps in correct order ✓✓ 3 steps in correct order ✓	2	3.3 3.4	**ALLOW** iodine for iodide

Question 11 · A level Paper 2 · June 2025 · Q16(a)(iii) · 2 marks

Question			Answer
16	(a)	(iii)	improves <u>contrast</u> / AW ✓ spindle (fibres) / chromosomes / cell (surface) membrane, darkly stained / (made) visible ✓

Mark	AO	Guidance
2 max	2.3	**ALLOW** identifying / differentiating AW for visible **IGNORE** nucleus / centromeres / chromatids / mitochondria

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

Question 12 · AS Paper 2 · November 2020 · Q1(a)(i) · 3 marks

1	(a)	(i)	2.3 3.4	*label* ribosome ✓ *explanation* cannot see with, this / light, microscope / need EM to see ✓ (LM) resolution, not high enough / too low ✓ (LM) magnification, not high enough / too low ✓ it is a nucleus ✓ **OR** *label* (large permanent) vacuole ✓ *explanation* it is an air bubble ✓ it spans more than one cell ✓ a vacuole is inside one cell ✓	3 max

1 mark for identifying incorrect label.
2 max for **matching** explanation.

IGNORE structure shown too large
ALLOW not visible / cannot be, viewed / detected for 'see'
ALLOW resolution not, sharp / clear / strong / detailed, enough

Question 13 · AS Paper 1 · June 2022 · Q25(b)(ii) · 3 marks

25	**(b)**	**(ii)**	light microscope ✓ **Any two from:** low magnification ✓ low resolution / resolution is not high enough for TEM/SEM ✓ can see, tissues / whole cells ✓

Max 3

IGNORE lower

ALLOW cannot see, organelles / components of cells / ultrastructure

If candidate answers transmission mic on top line:
ALLOW mark for 2D
IGNORE not 3D

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Question 14 · AS Paper 2 · June 2024 · Q5(b) · 2 marks

(b)	**1** magnification stated (in both figures) ✓ **2** all / only, (named) components in photomicrograph are drawn ✓ **3** no shading ✓ **4** correct proportions of, cells / nuclei ✓	**max 2**
	5 specifies type of cells / states <u>cheek</u> cells / specimen is named ✓	

IGNORE ref to what is not drawn on **Fig 5.2**

2 ALLOW only 2 cells are drawn
2 ALLOW nucleus is drawn (as seen in photomicrograph)

5 IGNORE has a title unqualified

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

Question			Answer
17	(b)	(ii)	**1** single cell **and** two parts to nucleus **and** broadly circular ✓ **2** clear continuous (single) lines (on nuclear and cell surface membranes) **and** ≥ 45 mm horizontal diameter ✓ **3** ruled label lines (touching feature) ✓ **4** nucleus **and** cytoplasm / cytosol **and** cell (surface) / plasma , membrane labelled ✓ **5** colour of any of above mentioned (as annotation) ✓

Mark	AO Element	Guidance
4 max	**3.3**	**1 DO NOT CREDIT** if anything obviously incorrect has been drawn **2 IGNORE** minor errors if it is clear candidate has attempted to draw continuous lines **3 DO NOT CREDIT** arrows / label lines that cross **4 DO NOT CREDIT** nuclei **4 IGNORE** nuclear , membrane / envelope **4 IGNORE** lysosomes **4 DO NOT CREDIT** any other labelled structures **5 ALLOW** e.g., nucleus is darker **5 DO NOT CREDIT** if shading has been used

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Question 16 · A level Paper 3 · June 2019 · Q1(a)(iii) · 2 marks

iii	no, shading / cross hatches / AW ✓ add, a scale / magnification ✓ add a title ✓	**2 max**

Mark first two improvements described

e.g. only use outlines

IGNORE references to labels or annotations and the use of a pencil (because this is mentioned in the question stem)

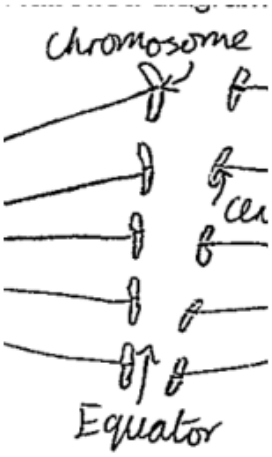
IGNORE drawing should take up half a page / no overlapping lines / use continuous lines

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

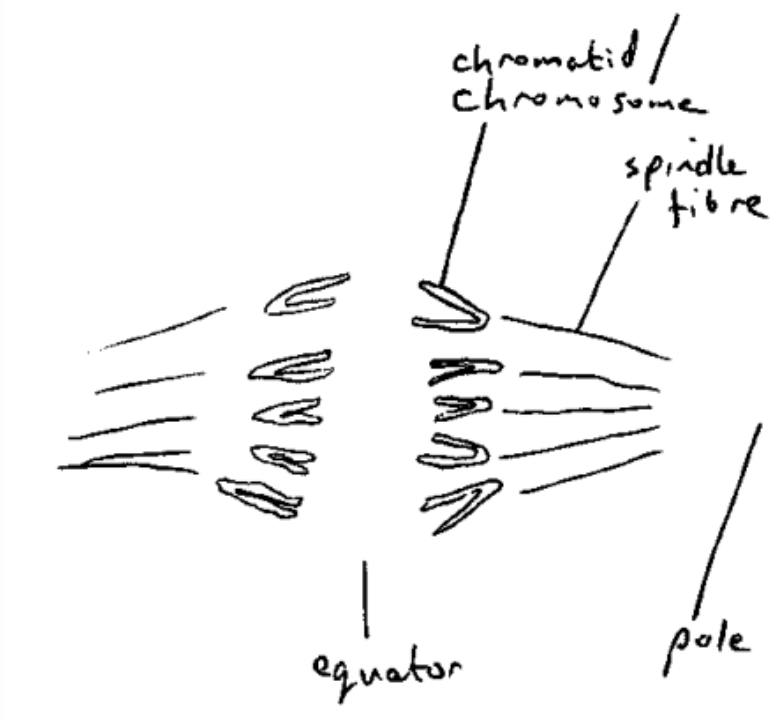
Question 17 · AS Paper 1 · June 2019 · Q23(b) · 3 marks

(b)	diagram showing at least 5 chromosomes pulled to each side with spindle fibres shown ✓ all labelling lines drawn with ruler **and** no arrows **and** end at structures ✓ **two** correct labels from chromatid, chromosome, equator, spindle (fibres), microtubules, pole, (position of) centriole, cytoplasm ✓	**max 3**

DO NOT ALLOW if chromosomes vertically aligned
e.g.



Example of correct diagram:



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