Cell Structure (2.1.1): OCR A Level Biology Exam Questions by Topic

17 questions · 39 marks · about 47 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 3 · June 2018 · Q1(a) · 2 marks

1 The onion plant, *Allium cepa*, is grown as a food crop around the world.

(a) The table below contains statements about the root cells of an onion.

Place ticks (✓) in the boxes in the table to indicate whether the statements are true or false.

Statement about onion root cells	True	False
contain chloroplasts		
contain mitochondria		
contain 70S ribosomes in the cytoplasm		
have pili		
have cellulose cell walls		

[2]

Question 2 · AS Paper 1 · June 2023 · Q28(a) · 4 marks

28 **(a)** Four organelles are listed in the table below.

Complete the table.

For each organelle place a tick (✓) in the box for a correct description and leave the box empty if the description is incorrect.

Organelle	A membrane-bound organelle	Found in both animal and plant cells	Has a role in lipid production
Rough endoplasmic reticulum			
Smooth endoplasmic reticulum			
Ribosome			
Mitochondrion			

[4]

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

1 Sago pondweed is an underwater plant that grows in many regions of the world.

Fig. 1.1 shows a transmission electron micrograph of a sago pondweed cell.

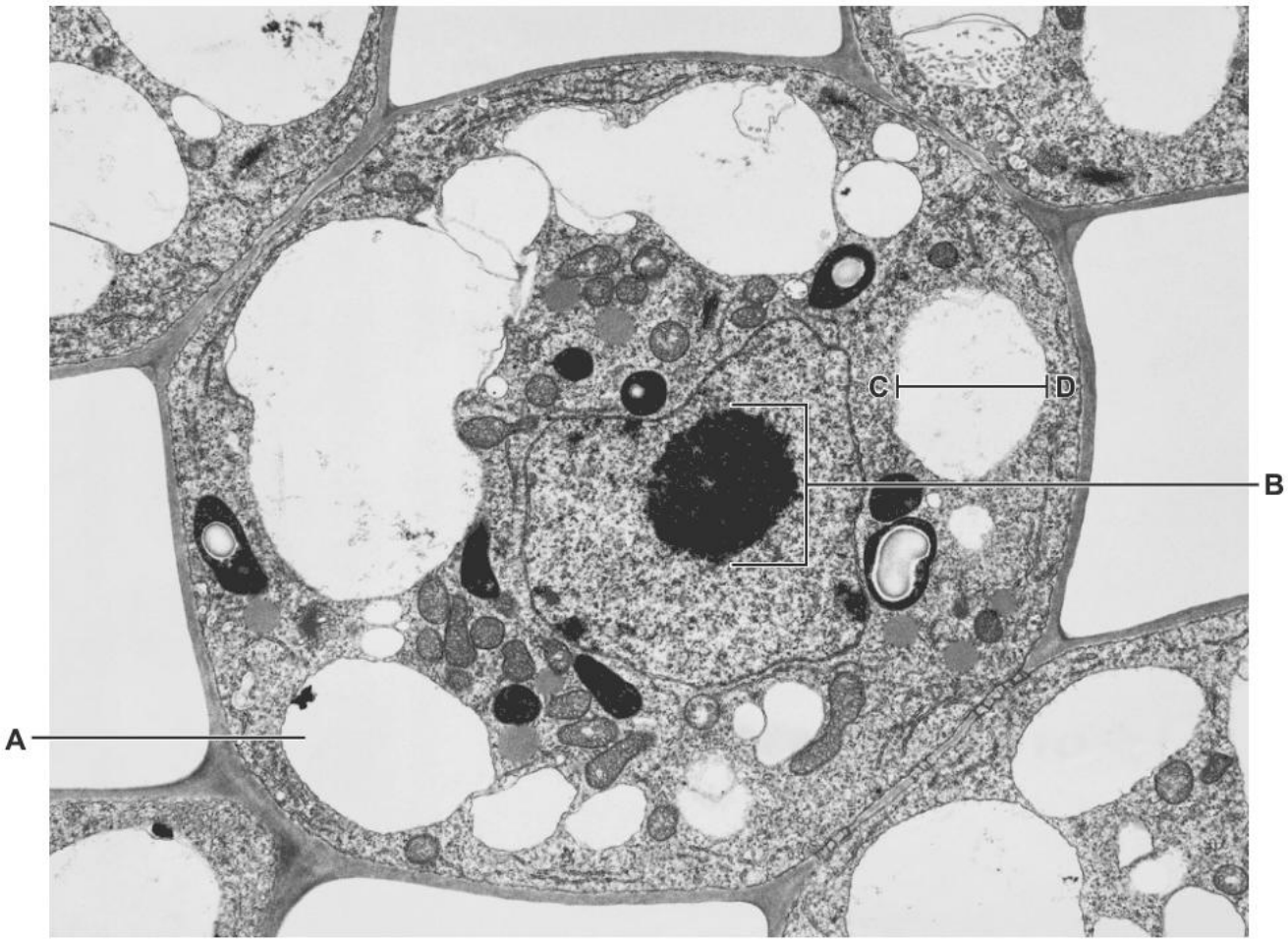


Fig. 1.1

(a) (i) Identify the **cellular components** shown at **A** and **B**.

A .....

B .....

[2]

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Question 4 · A level Paper 1 · June 2024 · Q21(a) · 3 marks

21

(a) Most digestive enzymes are extracellular.

Complete the sentences about the synthesis and secretion of a typical digestive enzyme using the most appropriate terms.

The polypeptide chain is assembled at ribosomes on the ..... .

After this, the protein is transported to the ..... where

further processing occurs. The final protein is packaged into .....

for transport to the plasma membrane where the protein is released by exocytosis.

[3]

Question 5 · A level Paper 1 · June 2023 · Q18(b)(i) · 3 marks

(b) Mutations in genes coding for proteins in the cytoskeleton have been associated with several diseases of the nervous system, including neurodegenerative disorders.

(i) Give **three** functions of the cytoskeleton.

1 .....

.....

2 .....

.....

3 .....

.....

[3]

Question 6 · AS Paper 1 · June 2019 · Q25(b)(i) · 1 mark

(b) The function of lysozyme is to break down the cell walls of bacteria.

(i) Name the molecule that is found in the cell walls of bacterial cells.

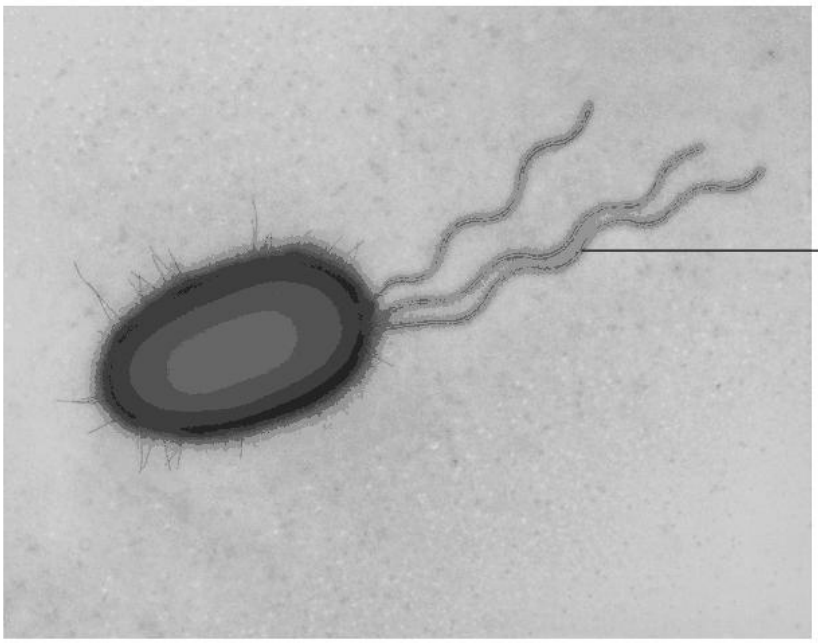
..... **[1]**

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Question 7 · A level Paper 3 · June 2024 · Q1(a)(i) · 1 mark

1 *Escherichia coli* is a bacterium that is used widely in scientific experiments and in biotechnology.

(a) This is a transmission electron micrograph of *E. coli*.



(i) Name the structure labelled **A**.

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

Question 8 · A level Paper 3 · June 2024 · Q1(a)(ii) · 1 mark

(ii) Based on your knowledge, **estimate** the diameter of the *E. coli* cell.

Give your answer in μm.

Diameter = ... μm **[1]**

Question 9 · A level Paper 1 · June 2023 · Q18(b)(ii) · 2 marks

(ii) Suggest how a mutation in cytoskeleton genes could cause a disease of the nervous system.

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.....

.....

.....

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

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Question 10 · AS Paper 2 · June 2019 · Q2(c)(i) · 3 marks

(c) The smear has been stained with haematoxylin and eosin stain. This is a differential stain.

- Haematoxylin stains nucleic acid blue.
- Eosin stains protein (including cytoplasmic proteins) pink or red.

(i) Explain why it is important to use a differential stain when examining a blood smear under the microscope.

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

Question 11 · AS Paper 2 · November 2020 · Q1(b) · 4 marks

(b) Both a transmission electron microscope (TEM) and a scanning electron microscope (SEM) can be used to view the same cell. However, the images formed will be different.

Compare the resolutions of these microscopes **and** the images formed by them.

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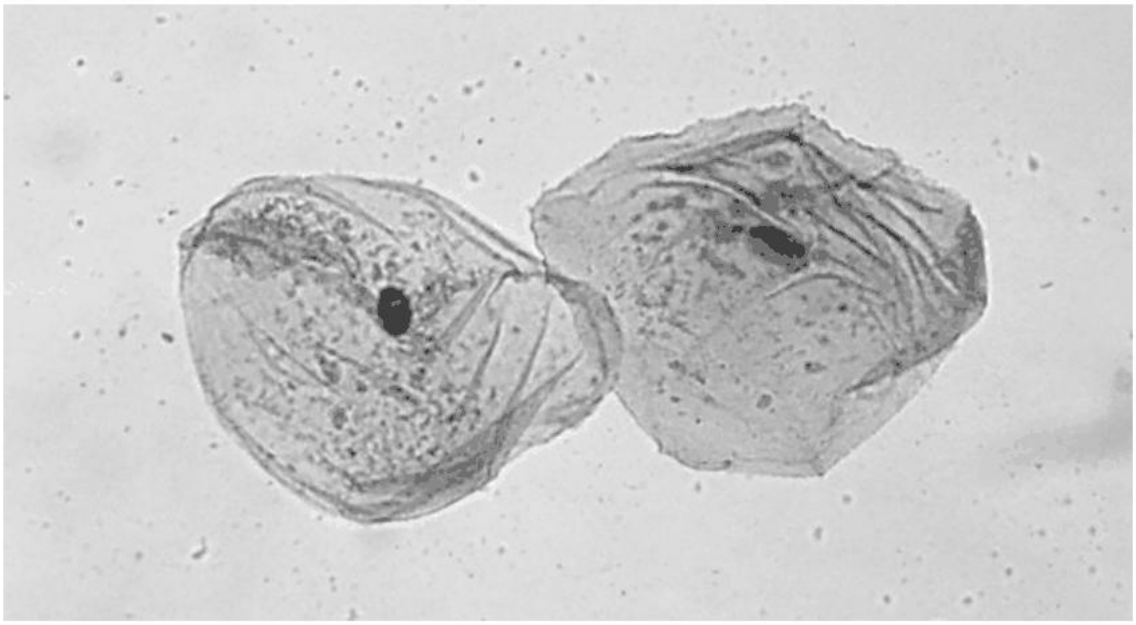
..... **[4]**

Turn over

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

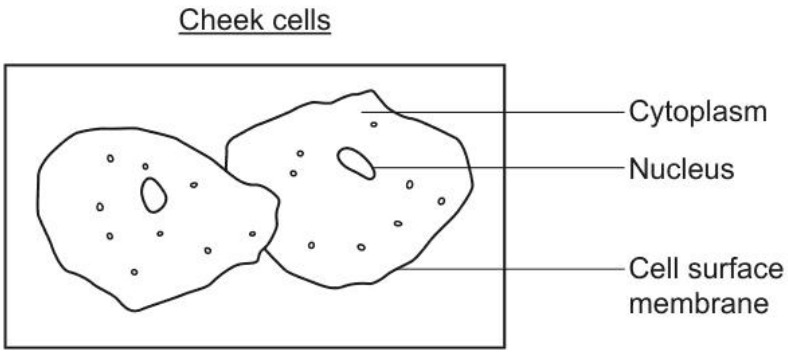
Fig. 5.1



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 .....

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.....

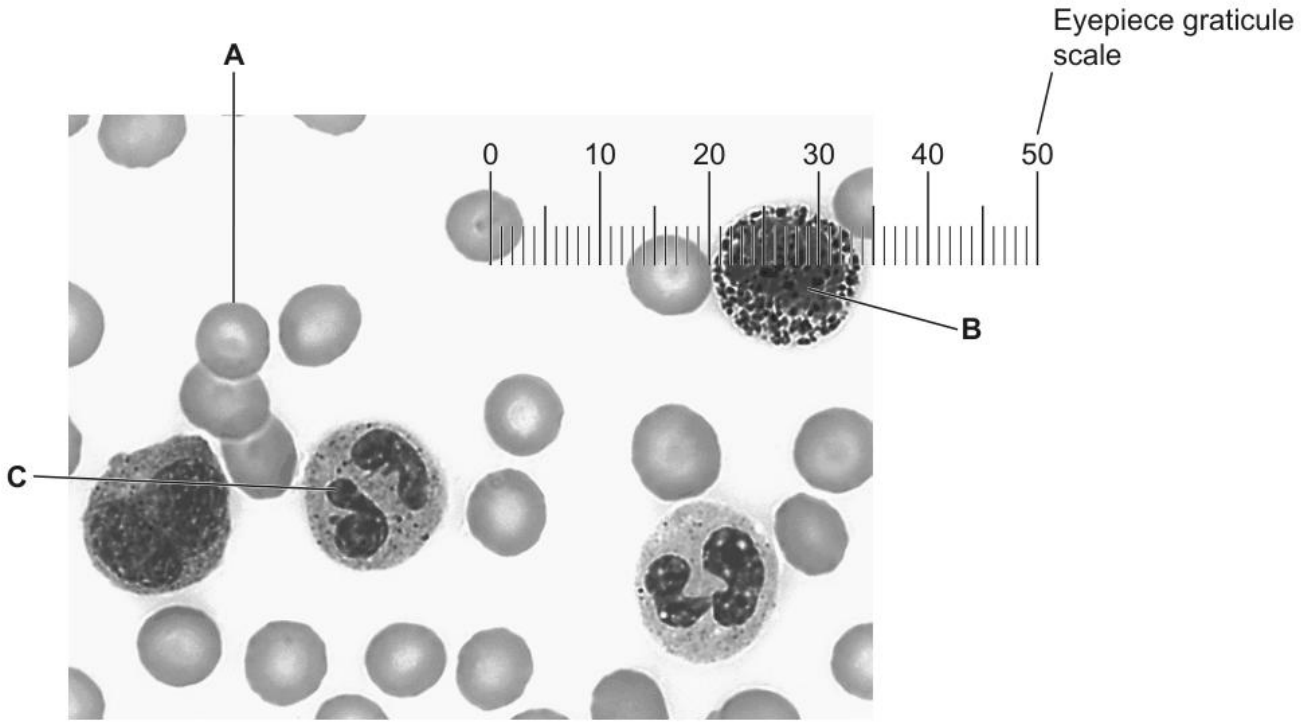
[2]

Turn over

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Question 13 · 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.

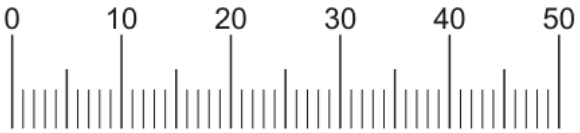
Name cell **A**.

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

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Question 13 · A level Paper 2 · June 2024 · Q17(b)(iii) · 3 marks

(iii) The image was taken using a ×40 objective lens. The eyepiece graticule scale for the ×40 objective lens was calibrated using the stage micrometer shown below.



Eyepiece graticule scale



Stage micrometer scale

Each of the three large divisions on the stage micrometer scale measured exactly 0.01 mm.

Calculate the diameter of cell **B**.

Give your answer in μm to **2** significant figures.

Diameter = ... μm **[3]**

Turn over

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Question 14 · information from earlier in the question

2 (a) **Fig. 2.1** shows a light micrograph of a blood smear.

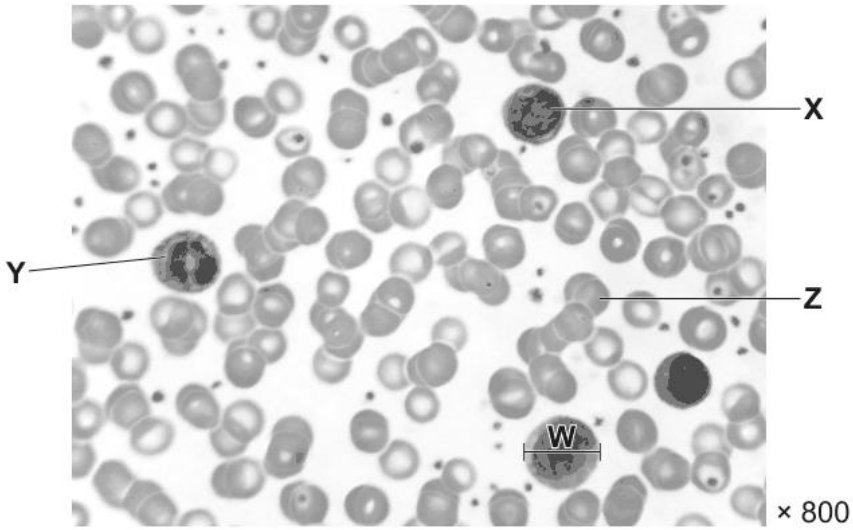


Fig. 2.1

(i) The cells labelled **X** and **Y** in **Fig. 2.1** are two different types of white blood cell.

Identify the types of white blood cell labelled **X** and **Y**.

X .....

Y .....

[2]

Question 14 · A level Paper 3 · June 2022 · Q2(a)(iii) · 2 marks

(iii) The diameter of another blood cell is represented by the line **W** in **Fig. 2.1**.

The magnification used to produce **Fig. 2.1** was × 800.

Calculate the actual diameter, **W**, of the blood cell.

Give your answer in μm.

Diameter = ... μm **[2]**

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

Question 15 · 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]**

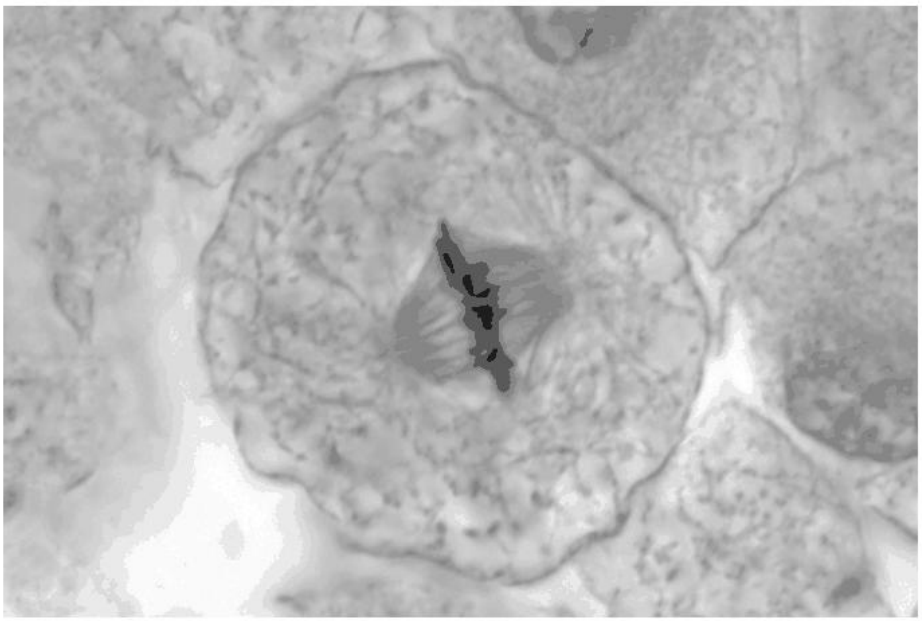
Turn over

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Question 16 · A level Paper 2 · June 2025 · Q16(a)(i) · 2 marks

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 17 · A level Paper 2 · June 2025 · Q16(a)(ii) · 2 marks

(ii) Calculate the horizontal diameter of the cell shown in the image.

Give your answer in μm.

Diameter = ... μm **[2]**

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Mark schemes

Question 1 · A level Paper 3 · June 2018 · Q1(a) · 2 marks

1 a

Statement about onion root cells	True	False
contain chloroplasts		✓
contain mitochondria	✓	
contain 70S ribosomes in cytoplasm		✓
have pili		✓
have cellulose cell walls	✓	

3 correct = ✓
all correct = ✓✓

2 **ALLOW** use of crosses in place of ticks

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28 (a)

organelle	a membrane-bound organelle	found in both animal and plant cells
rough endoplasmic reticulum	✓	✓
smooth endoplasmic reticulum	✓	✓
ribosome		✓
mitochondrion	✓	✓

has a role in lipid production	4	one mark per correct row **IGNORE** crosses
✓		

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

1	a	i	A = (permanent / temporary) vacuole ✓ B = nucleolus ✓	2	**ALLOW** vacule **DO NOT ALLOW** nucleus

Question 4 · A level Paper 1 · June 2024 · Q21(a) · 3 marks

21	(a)	rough endoplasmic reticulum / RER ✓ Golgi (body / apparatus) ✓ (secretory / transport) vesicle(s) ✓	3	**ALLOW** lysosome

Question 5 · A level Paper 1 · June 2023 · Q18(b)(i) · 3 marks

18	(b)	(i)	1 movement of cells ✓ 2 strengthening / supporting , cells ✓ 3 movement of (named) organelles ✓ 4 holds organelles in place ✓ 5 form (mitotic / meiotic) spindle ✓ 6 movement of , chromatids / chromosomes ✓ 7 cleavage in (some) cells / cytokinesis ✓	

max 3	1.2	**Mark as continuous prose** **IGNORE** cilia / flagella **MP1 ALLOW** change in cell shape e.g phagocytosis **MP2 ALLOW** maintains cell shape **IGNORE** structure **MP3 ALLOW** form tracks for motor proteins **MP4 ALLOW** attachment of (named) organelle(s) **MP7 IGNORE** cleavage / cytokinesis , in plant cells

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Question 6 · AS Paper 1 · June 2019 · Q25(b)(i) · 1 mark

(b)	**(i)**	peptidoglycan / murein ✓		**1**

Question 7 · A level Paper 3 · June 2024 · Q1(a)(i) · 1 mark

1	**(a)**	**(i)**	flagellum ✓	**1**	**ALLOW** flagella **ALLOW** phonetic spelling e.g flagela, flaegella **DO NOT ALLOW** undulipodia/ undulipodium (*as found in eukaryotic cells only)*

Question 8 · A level Paper 3 · June 2024 · Q1(a)(ii) · 1 mark

1	**(a)**	**(ii)**	0.1 – 10 (μm) ✓	**1**	**ALLOW** any single value in the range *(from knowledge of prokaryote size not working from a magnification)*

Question 9 · A level Paper 1 · June 2023 · Q18(b)(ii) · 2 marks

18	**(b)**	**(ii)**	**1**	change in , structure / function , of (cytoskeleton) protein ✓
			2	less / no , movement of vesicles / exocytosis / release of neurotransmitter ✓
			3	less / no , synaptic transmission / AW ✓
			4	could change diameter of axon ✓
			5	affects speed of nerve impulses ✓
			6	*idea that* it could affect Schwann cell integrity / AW ✓

max 2	**2.1**	**MP1 ALLOW** non-functional protein is produced **MP2 DO NOT ALLOW** 'no vesicles released' **MP3 ALLOW** impulse cannot cross synapse / action potentials do not continue from one neurone to the next **MP3 DO NOT ALLOW** action potential cannot cross the synapse

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Question 10 · AS Paper 2 · June 2019 · Q2(c)(i) · 3 marks

(c)	(i)	**1** to, see / identify, (differences between) cells ✓ **2** to, see / identify, (differences between) organelles ✓ **3** red blood cells visible, anyway / without stain (due to haemoglobin) ✓ **4** ref. <u>contrast</u> ✓ **5** allows, white cells / leucocytes, to be counted ✓	**max 3**

ALLOW so white blood cells / **A** / **C** / **D** can be seen or told apart from RBCs

ALLOW named organelles e.g nucleus / cytoplasm

ALLOW without stain white cells are, transparent / colourless

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Question 11 · AS Paper 2 · November 2020 · Q1(b) · 4 marks

1	(b)	1.1	TEM has, better / higher, resolution ✓ *TEM* (resolution figure in range) 0.05 - 2 nm ✓ (shows) image of cell interior ✓ (shows) ultrastructure / (two named) cell organelles ✓ *SEM* (resolution figure in range) 5 - 50 nm ✓ (shows) 3D / three-dimensional, image ✓ (shows cell) surface / topography ✓

4 max	**ALLOW ora** SEM has, worse / lower resolution **IGNORE** magnification **ALLOW** 0.00005 - 0.002 µm / 50 – 2000 pm 'TEM has resolution of 0.5nm whereas SEM **only** has resolution of 3-10nm' gets mps 1, 2, 5 (as comparative implied by 'only') **ALLOW** 0.005 – 0.05 µm **ALLOW** see depth **DO NOT ALLOW** organelles in cell unless fracture explained

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Question 12 · 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

Question 13 · A level Paper 2 · June 2024 · Q17(b)(iii) · 3 marks

Question				Answer	Mark	AO Element	Guidance
17	(b)	(iii)		**FIRST CHECK ON ANSWER LINE** **If answer = 8.0 (± 0.3) µm award 3 marks**	3	2.8	*Where an answer is not obviously covered by the mark scheme, a single error should mean that only one of the marking points is not credited, e.g.,* '82' or '0.79' = 2 marks (mp 1 and mp 3).
			1	*correctly reading the diameter with the graticule and mapping this measurement onto the stage micrometer* diameter = 8.0 (± 0.3 divisions) / 0.008 (mm) ✓			**AWARD** this mark for any answer where the first 2 significant figures are in the range 77 to 83
			2	*converting units* 0.008 mm = 8.0 (µm) ✓			**AWARD** this mark if the final answer is between 5 and 10 (µm)
			3	*using correct number of significant figures.* answer in µm to 2 significant figures ✓			**AWARD** this mark if the final answer given to 2 significant figures

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Question 14 · A level Paper 3 · June 2022 · Q2(a)(iii) · 2 marks

2	(a)	(iii)	**FIRST CHECK ON ANSWER LINE** **If answer = 13 award 2 marks** 10 mm / 800 (= 0.0125mm) ✓ 0.0125mm x 1 000 (= 12.5µm) ✓

2	2.8	**ALLOW** 12.5 for 2 marks **ALLOW** answer to more than 3 s.f. for 1 mark **ALLOW ECF** if incorrect measurement of cell W **with units** used but divided by 800 for 1 mark **or** measurement of cell W **with units** correctly converted to µm for 1 mark **ALLOW** 0.01m / 800 (= 0.0000125m) **and** 0.0000125m x 1 000 000 (= 12.5µm) **ALLOW** 1cm / 800 (= 0.00125cm) **and** 0.00125 x 10 000 = (12.5µm) **If candidate measures cell W as 9.5 mm** **ALLOW 12 /11.9 for 2 marks and 11.88/11.875 for 1 mark** **If candidate measures cell W as 10.5 mm** **ALLOW 13 /13.1 for 2 marks and 13.13 / 13.125 for 1 mark**

Question 15 · 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

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Question 16 · A level Paper 2 · June 2025 · Q16(a)(i) · 2 marks

16	**(a)**	**(i)**	2D image / image **not** 3D ✓ (named) organelles / sub-cellular structures / ultrastructure , not (clearly) visible ✓ low(er) resolution ✓	**2 max**

3.2	*Mark as prose (ignore prompt lines)* **ALLOW** cannot see , ribosomes / mitochondria **IGNORE** magnification

Question 17 · A level Paper 2 · June 2025 · Q16(a)(ii) · 2 marks

16	**(a)**	**(ii)**	**FIRST CHECK ON ANSWER LINE** **If answer = 33.5 or 34 (µm) award 2 marks** diameter = 66 – 68 mm 68/2000 = 0.034 mm ✓	**2**

2.4	**ALLOW** between 33 and 34 for 2 marks **ALLOW** 1 mark for correct answer in incorrect unit to 2 s.f., e.g. between 0.033 and 0.034 **ALLOW ECF** if incorrect measurement of cell with units used but divided by 2000 for 1 mark

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