

Question	Answers	Extra information	Mark	AO / Specification reference
01.1	A – chloroplast B – nucleus C – cell membrane		1 1 1	AO2 1.1.2
01.2	when filled with cell sap it puts pressure on cell wall keeping the cell rigid / supporting plant		1 1 1	AO1 1.1.2
01.3	nucleus		1	AO2 1.1.1
01.4	leaf / stem contains chloroplasts		1 1	AO2 1.1.2
02.1	wear gloves / wash hands – methylene blue / stain is an irritant or disinfect work surfaces / dispose of used swabs – to prevent spread of possible infection	allow 1 mark for safety measure and 1 mark for linked explanation	2	AO1 1.1.5
02.2	makes nucleus / subcellular structures more visible		1	AO1 1.1.5
02.3	use a higher-power objective lens	allow use an electron microscope	1	AO1 1.1.5

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02.4	length of the cell = 4.8 cm $\frac{4.8}{1350} = 0.0036 \text{ cm}$ = 36 μm	award full marks for correct answer with no working shown accept 35 μm for 3 marks allow 0.0036 cm for 2 marks	1 1 1	AO2 1.1.5 Ms1c
03.1	group of cells with similar structure working together to perform a function		1	AO1 1.1.3
03.2	lignin builds up in cell walls cells die form (long hollow) tubes		1 1 1	AO1 1.1.3
03.3	long hollow tubes allow water/ mineral ions to move easily around plant lignin makes cells very strong can withstand pressure of water moving / help support the plant stem		1 1 1 1	AO1 1.1.3
03.4	phloem		1	AO1 1.1.3
04.1	chloroplast		1	AO2 1.1.2
05.1	Level 3: Two advantages and two disadvantages are detailed and accurate. Evaluation is clear and coherent.		5–6	AO2 \times 4
	Level 2: Some advantages and disadvantages are correct. Evaluation is attempted but may not be clearly explained.		3–4	AO3 \times 2 1.1.5

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	Level 1: One or two advantages / disadvantages given, but evaluation is missing or lacks clarity and coherence.		1–2	
	No relevant content.		0	
	Indicative content Advantages of electron microscope: <ul style="list-style-type: none"> • higher magnification • higher resolution • scanning electron microscopes can be used to examine the surface structure of cells/structures Advantages of light microscope: <ul style="list-style-type: none"> • do not damage living cells / can be used to observe living things • light microscopes are cheaper • more readily available • can be used by less-skilled operator Evaluation: <ul style="list-style-type: none"> • light microscopes are appropriate to use when the whole organism / behaviour of the organism is to be studied / without damaging the organism • electron microscopes are appropriate to use when detail of (sub-cellular) structures is required 	award 2 marks for 2 advantages, 2 marks for 2 disadvantages, 2 marks for explanations of points (accept reverse answer as a disadvantage of other technique)		

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05.2	diameter of amoeba: $10\ \mu\text{m} = 1 \times 10^{-5}\ \text{m}$ diameter of egg cell: $0.1\ \text{mm} = 1 \times 10^{-4}\ \text{m}$ difference in order of magnitude: $5 - 4 = 1$ / a factor of 10		1 1 1	AO2 Ms 1c, 2h
06.1	A		1	AO2 1.1.5 1.1.2
06.2	where protein synthesis takes place / proteins are made		1	AO1 1.1.2
06.3	mitochondria		1	AO2 1.1.2
06.4	Level 3: All key steps are identified and logically sequenced.		5–6	AO1 1.1.2 1.1.5
	Level 2: Most steps are identified, but the method is not fully logically sequenced.		3–4	
	Level 1: Some relevant steps are identified, but links are not made clear.		1–2	
	No Relevant content		0	

Question	Answers	Extra information	Mark	AO / Specification reference
	<p>Indicative content</p> <ul style="list-style-type: none"> • cut slice of plant (using a knife or scalpel) • place on microscope slide • add a drop of stain (such as iodine) • carefully lower a coverslip onto the slide • use a piece of filter paper to soak up any liquid from around the edge of the coverslip • put the slide on the microscope stage at its highest setting • choose the lowest powered objective lens • lower slide using focusing knob until the cells come into focus <p style="text-align: center;">repeat with higher objective lens to get a more detailed image</p>			
07.1	1 μm		1	AO1 1.1.1
07.2	plant cell walls contain cellulose / bacterial cell walls contain peptidoglycan		1	AO1 4.1.1.3
07.3	in eukaryotic cells DNA is contained in nucleus long strands called chromosomes in bacteria cells DNA is found in cytoplasm / not in a nucleus in a single loop also have extra small rings of DNA / plasmids		1 1 1 1	AO1 1.1.1
07.4	flagellum / flagella		1	AO1 1.1.1

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08.1	any four from: the visual pigment detects / is affected by light light causes a chemical change in visual pigment the chemical change creates an impulse impulse passed through synapses to the optic nerve / through optic nerve to the brain (lots of) mitochondria transfer (lots of) energy for the cell to reform the visual pigment / reverse change in the visual pigment		4	AO1 1.1.1
08.2	$\frac{6\,000\,000}{3}$ = 2 000 000 = 2×10^6	allow 2×10^6 with no working shown for 3 marks	1 1 1	AO3 1.1.3
09.1	a cell that is adapted / has special features to perform a particular function		1	AO2 1.1.3 Ms 1b
09.2	to contract (and relax)		1	AO1 4.1.1.3

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09.3	digestive system to squeeze food along the gut or in the heart so heart can contract to pump blood around the body	allow 1 mark for muscle location allow 1 mark for description of role in that location	2	AO1 4.1.1.3
09.4	to respire to transfer the energy needed for the cell to contract		1 1	AO1 4.1.1.3
09.5	contain proteins / actin and myosin that slide over one another to cause the cell to contract or store glycogen that can be broken down (into glucose) and used for respiration	allow 1 mark for feature allow 1 mark for explanation	2	AO1 4.1.1.3
10.1	cell wall present cells fit clearly together / no gaps between cells / uniform appearance		1 1	AO2 4.1.1.2 4.1.1.5
10.2	$\frac{1000}{3}$ = 77 (μm)	allow 77 (μm) with no working shown for 2 marks	1 1	AO2 4.1.1.5
10.3	vacuole		1	AO1 4.1.1.2

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11.1	A		1	AO2 4.1.1.2
11.2	control what comes in and out of the cell		1	AO1 4.1.1.2
11.3	axon would be present to transmit impulses around the body dendrites / dendrons present to connect to other nerve cells	allow reference to myelin sheath and its function	1 1 1 1	AO1 4.1.1.3
11.4	length = $\pi \times d = 3.14 \times 20 \times 10^{-6}$ = 6.28×10^{-5} m / 62.8 μ m	unit must be given to award mark allow 6.28×10^{-5} m / 62.8 μ m with no working shown for 2 marks	1 1	AO2 4.1.1.1
11.5	62.8 μ m = 62 800 nm $\frac{62\ 800}{4}$ = 15 700	allow 15 700 with no working shown for 3 marks	1 1 1	AO2 4.1.1.1
12.1	10 μ m		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Specification reference
12.2	similarities: <ul style="list-style-type: none"> • presence of cytoplasm • presence of cell membrane • both contain genetic material • cell wall found in prokaryotes and some (plant) eukaryotes differences: <ul style="list-style-type: none"> • prokaryotes have plasmids • prokaryotes have no nucleus • prokaryotes have single loop of genetic material • plant cell walls are made of cellulose, prokaryote cell walls are made of peptidoglycan / not made of cellulose 	award 1 mark per similarity or difference award a maximum of 4 marks for similarities or 4 marks for differences allow converse statements	6	AO1 4.1.1.1
12.3	1 μm cyanobacteria are prokaryotes, which are one order of magnitude smaller than typical eukaryotes	accept answer given in 12.1	1 1	AO2 4.1.1.5
12.4	algal cells contain features / cell components / organelles also seen in plant cells: cell wall chloroplasts	ignore reference to nucleus and cell membrane	1 1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Specification reference
13.1	any two from: <ul style="list-style-type: none"> • long tail – move • lots of mitochondria – transfer energy needed to move the cell • acrosome contains digestive enzymes – to break down outer layers of the egg • nucleus – contains genetic material (to pass on) 	award 1 mark for adaptation award 1 mark for explanation of adaptation	4	AO1 4.1.1.3
13.2	sperm cells need to be alive / not damaged to observe movement light microscope are cheap / readily available / do not require high level of training to use		1 1	AO3 4.1.1.3 4.1.1.5
13.3	$7.5 \text{ cm} = 75\,000 \mu\text{m}$ $\frac{75\,000}{1500}$ $= 50 (\mu\text{m})$	allow 50 (μm) with no working shown for 3 marks	1 1 1	AO2 4.1.1.5
14.1	Level 3: All key steps are identified and logically sequenced.		5–6	AO2 4.1.1.5
	Level 2: Most steps are identified, but the method is not fully logically sequenced.		3–4	
	Level 1: Some relevant steps are identified, but links are not made clear.		1–2	
	No Relevant content		0	

Question	Answers	Extra information	Mark	AO / Specification reference
	<p>Indicative content</p> <ul style="list-style-type: none"> • wipe inside of the cheek with a cotton swab • smear cotton swab on the centre of the microscope slide • add a drop of stain • carefully lower a coverslip onto the slide. • use filter paper to soak up any liquid from around the edge of the coverslip. • put the slide on the microscope stage at its highest setting • choose the lowest powered objective lens • carefully lower slide using focusing knob until the cells come into focus • for more detail repeat with higher power objective lens 			
14.2	cell membrane nucleus cytoplasm	allow additional label to mitochondria	1 1 1	AO2 4.1.1.5 4.1.1.2
14.3	magnification used		1	AO2 4.1.1.5
14.4	the smallest object that can be viewed under a microscope		1	AO1 4.1.1.5
14.5	by using an electron microscope		1	AO1 4.1.1.5