Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1	a		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 ✓ 4. slide / cover slip , at an angle ✓ 5. AVP ✓	3 max (AO 1.2 x 1) (AO 3.3 x 2)	**CREDIT** answers from an annotated diagram **IGNORE** staining **3 ALLOW** smear as AW for spread **5 CREDIT** allow to (air) dry **Examiner's Comments** Most candidates scored at least one mark on this question, usually marking point 1, and many achieved all 3. Marking points 3 and 4 were also frequently given. No credit was given for describing staining or focussing as these were outside the scope of the question.
	b	i	erythrocyte ✓	1 (AO 1.1)	**ALLOW** spelling that is phonetically loosely equivalent **Examiner's Comments** Most candidates got this correct and examiners were tolerant of a range of phonetically similar spellings. Some candidates wrote 'red blood cell', despite the question ruling this out as an answer.
		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**	4 max (AO 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 **Examiner's Comments**

			5. cytoplasm / cytosol **and** cell (surface) / plasma , membrane labelled ✓ colour of any of above mentioned (as annotation) ✓		This question differentiated well. Almost all candidates drew one cell that was roughly circular. A small number of candidates included only one of the two visible parts of the lobed nucleus. The cell drawings were, by and large, a reasonable size, and most candidates attempted to use continuous, single lines without any shading or hatching. Most label lines were ruled. Some candidates labelled the two parts of the lobed nucleus as 'nuclei' or 'phagosome'. A number of candidates also attempted to draw and label structures that are not visible in the image, such as mitochondria, ribosomes and ER. **OCR support** Guidance on biological drawings is available in the drawing skills handbook at: Drawing skills handbook Biology Learner checklist: Graphs, Tables and drawings
		iii	**FIRST CHECK ON ANSWER LINE** **If answer = 8.0 (± 0.3) µm award 3 marks** 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) ✓ 2 *converting units* 0.008 mm = 8.0 (µm) ✓ 3 *using correct number of significant figures*. answer in µm to 2 significant figures ✓	3 (AO 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). **AWARD** this mark for any answer where the first 2 significant figures are in the range 77 to 83 **AWARD** this mark if the final answer is between 5 and 10 (µm) **AWARD** this mark if the final answer given to 2 significant figures **Examiner's Comments** Only around half of candidates were able to use the scales to correctly measure the image and, of those, a small majority could successfully manipulate the units to micrometres. Having got that far, a minority of candidates then unnecessarily divided a perfectly serviceable answer by the objective lens magnification. Around 1 in 10 candidates

					achieved all 3 marks but the vast majority scored at least 1, usually for presenting an incorrect final answer to the correct number of significant figures.
			Total	**11**	
2			B✓	1 (AO 1.1)	**Examiner's Comments** The vast majority of responses were correct.
			Total	**1**	
3	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) **Examiner's Comments** Few candidates achieved full marks. Many answers discussed improving the method in terms of not pouring the pondwater on the slide but suggested a smear approach, not appreciating that a smear would effectively be a dried sample that would not be appropriate to observe the contents of pond water. A lot of candidates referred to a coverslip but could not recall its name, describing it instead or referring to another slide. Some answers indicated the use of dyes to visualise the contents of pond water. **Misconception** Many candidates believe that dyes are required to see anything using a light microscope. Dyes are required to distinguish cell types and subcellular structures. Organisms can be seen under a light microscope without the need for a colour contrast.
		ii	**1** select low power lens then higher power ✓ **2** use coarse focus to find, correct field of view / object ✓	max 2	**1 ALLOW** magnification for 'power' **2 ALLOW** adjustment for 'focus' **2 IGNORE** ref to fine focus for finding correct field of view

			3 use fine focus for clear(er) image ✓ **4** *ref to* x4 / x10 / x40 (lens power / magnification) ✓		**3 IGNORE** ref to coarse focus for getting a clear image **Examiner's Comments** Candidates struggled to elicit a clear response. Many correctly referred to the objective lenses and starting with the lowest magnification lens but could not articulate how to focus on the pondwater. Answers were often confused with stating the lens as the focusing component on the microscope. Some candidates referred to altering the resolution. **Assessment for learning** Highlighting the difference in resolution between a light microscope and an electron microscope helps to emphasise the fixed nature of resolution for each type of microscope. **Misconception** Candidates often confuse magnification with resolution and thus refer to adjusting the resolution of a light microscope as you are using it.
	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 ✓ **5** specifies type of cells / states <u>cheek</u> cells / specimen is named ✓	max 2	**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 **Examiner's Comments** Well answered with most candidates referring to no shading and the magnification. Many candidates also appreciated the relative size of the drawing in relation to the

					photomicrograph. Some answers discussed the label lines and lack of arrow heads as a piece of evidence without appreciating the question refers to both figures to support the student's statement and not just a list of rules for a good biological drawing.
			Total	**6**	
4		i	flagellum ✓	1	**ALLOW** flagella **ALLOW** phonetic spelling e.g flagela, flaegella **DO NOT ALLOW** undulipodia/ undulipodium (*as found in eukaryotic cells only*) **Examiner's Comments** The majority of candidates answered this correctly and were able to correctly spell the term flagellum. When there was an incorrect response, it often stated tail, cilia or undulipodium (which is found in eukaryotic cells only).
		ii	0.1 – 10 (μm) ✓	1	**ALLOW** any single value in the range *(from knowledge of prokaryote size not working from a magnification)* **Examiner's Comments** Most candidates gained this mark, however, a few candidates clearly did not understand the question and tried to calculate a size from the diagram (although no magnification was given) or on occasions stated the answer with the incorrect unit, e.g. nm.
			Total	**2**	
5		i	*Safety precaution* cut away from the body **or** *idea that* only one person at a time should work on the specimen **or** use sharp, scalpel / scissors / knife / (razor) blade ✓ *explanation*	2max	**mark as prose** *Explanation mark can only be awarded if linked to **relevant** idea of safety precaution* *examples 'be careful when using, a scalpel / sharp instruments, to avoid cutting yourself = 1 mark (no precaution but has explanation) 'wear goggles to prevent plant sap going into your eye' =2 marks (safety precaution and explanation)* **IGNORE** 'be careful when using a scalpel' / 'take care when using sharp instruments' **ALLOW** 'take care when using a sharp, scalpel / scissors / knife / razor blade' **ALLOW** use forceps to hold plant tissue / use

			to avoid cuts / AW ✓ **OR** *Safety precaution* wash specimen / wash hands / wear gloves ✓ *explanation* to avoid, infection (with plant pathogens) / allergic reaction / AW ✓		of, dissection board / glass tile / slate e.g. to avoid penetrating the skin' / 'to avoid stabbing, yourself / someone else' **ALLOW** wear eye protection **Examiner's Comments** Most candidates achieved at least one mark in this question. Many were able to achieve both marking points. This was most often achieved by describing the use of a sharp scalpel (or similar) linked to the risk of cutting themselves. Many described cutting the vascular tissue away from themselves. However, it was less common for those candidates who selected to wear gloves or eye protection to accurately describe an appropriate risk; many responses described the use of gloves or goggles as a measure to reduce cuts, rather than avoid plant material causing irritation or infection.
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.17 award two marks** 15 (mm) / 90 **or** 0.166 ✓ (2 significant figures =) 0.17 (mm) ✓	2	**ALLOW** 1 mark if answer not given to 2 sig figs **ALLOW** any number of significant figures for mp1 (the working mark) **ALLOW ECF** from step 1 for an incorrect measurement divided by 90 **and** correctly rounded to 2 sig figs for **1 mark** e.g. 1.5(cm) / 90 = 0.0166 **and** = 0.017 for 1 mark **Examiner's Comments** This mathematical calculation posed little challenge to the majority of candidates. The most frequent source of error related to undertaking the initial measurement in centimetres and not correctly converting this unit to millimetres. Occasionally, candidates did not round the response appropriately. An incorrect measurement divided by 90 and correctly rounded to 2 sig figs was awarded 1 mark.

			Total	**4**	
6			B ✓	1	**Examiner's Comments** Many candidates were able to identify the correct cells in the image provided and selected B as the correct response. Examination of microscope images/micrographs and drawing skill activities linked to the different types of leucocytes can reinforce the key features of the different types.
			Total	**1**	
7			C ✓	1	**Examiner's Comments** The question is testing one of the practical skills. Only a few students selected the correct response, C. The most common incorrect response was D presumably because candidates picked up on the 21 units mentioned in the stem of the question and multiplied this by 10. **Assessment for learning** Practical skills are an important component of GCE Biology. Centres should appreciate that even at AS Level practical skills must be part of the teaching and will be tested in the written examination papers.
			Total	**1**	
8			B ✓	1 (AO1.2)	**Examiner's Comments** The responses in this question varied a lot. Around half of the candidates selected the correct option, **B.** This might be due to lack of practical experience.
			Total	**1**	
9			A ✓	1 (AO1.1)	**Examiner's Comments** Just over half of the candidates selected the correct option; **A.** The most incorrect response was option **B**.
			Total	**1**	
10		i	*idea of* so bacterial cells are evenly distributed ✓	1(AO3.4)	

					Examiner's Comments About half of the responses achieved this mark. It was often stated the sample was needed to be mixed, or because bacteria will have settled to the bottom, but many responses omitted the explanation that an even distribution of bacteria was required. As in part (i), responses that discussed colonies or spreading bacteria on agar were not given marks.
		ii	small(er size)✓	1(AO3.4)	**ALLOW** size similar to wavelength of (visible) light **IGNORE** reference to resolution of microscope **Examiner's Comments** This synoptic question tested candidates' knowledge about relative cell size of eukaryotic (human) and prokaryotic (bacterial) cells in the context of using a light microscope to count them. Most responses gained this mark. A significant minority discussed microscope resolution without mentioning size and received no marks while others cited the absence of a nucleus to take up stain. A few candidates mistakenly thought that the bacterial cells would be moving due to flagella, or that they would be dividing rapidly, so would be difficult to count.
		iii	*Calculate the number in 10 cm*^{3} **1** multiply , 52 / number of bacteria in sample , by 1000 ✓ *Correct treatment of serial dilutions* **2** multiply by , 100^n (where n is the number of serial dilutions) ✓ *Calculate the total in 50 cm*^{3} **3** multiply (answer to **1**) by 5 ✓	3(AO2.8)	*Credit steps in any order* **1 ALLOW** if 52 000 seen as part of a calculation **1 ALLOW** 52 x 100 if working out number in 1cm^3 **3** 52 × 5 000 = 2 marks (**1** and **3**) *If mp1 has not been awarded* **ALLOW** 1 mark for 260 000 **ALLOW** answer written as single formula, e.g., • 52 × 1000 × 100^n × 5 = 3 marks • 52 000 × 100^n × 5 = 3 marks • 52 × 100 × 100^n × 50 = 3 marks (if working out no. in 1cm^3 first)

					• $100^n \times 260\,000$ = 2 marks (steps not clearly described) **Examiner's Comments** Candidates found this unfamiliar style of question challenging. Although most gained at least 1 mark, it was rare to award all 3 marks. The most common mark given was for multiplying by a correct number to get the number of bacteria in 10 cm^3 or 1 cm^3. Some then went on to multiply this by the appropriate number, 5 or 50, to get the number in 50 cm^3. Very few candidates were able to clearly demonstrate how to deal with the number of serial dilutions, hence, the 2nd marking point was achieved only by the strongest candidates and this was normally written out rather than expressed as a formula. Some candidates did not attempt to describe the steps as the question asked but treated it as a calculation with a correct answer. This approach meant they could not access the 2nd marking point, as the number of serial dilutions was not stated in the question.
			Total	**5**	
11	a	i	(X) (T or B) lymphocyte ✓ (Y) neutrophil ✓	2(AO2.3)	**ALLOW** T cell / B cell / T helper cell / T killer cell / T regulator cell **ALLOW** phagocyte **Examiner's Comments** Most candidates only got 1 mark for correctly naming Y as a neutrophil. The most common errors were incorrectly naming X as a macrophage or monocyte, with few candidates correctly identifying it as a lymphocyte.
		ii	flattened / biconcave (shape), to increase surface area (to volume ratio) ✓ no, nucleus / organelles, to give (more) space for haemoglobin ✓ flexible, to increase surface area in contact with <u>capillary</u> wall / to	2 max(AO1.1)(AO2.1)	**IGNORE** concave **ALLOW** few organelles so more haemoglobin can be in the cell **IGNORE** to give (more) space for oxygen 'cells are small and flexible to fit through capillaries' = 2 marks **Examiner's Comments** This question was generally answered well by a wide range of candidates. Common errors

			squeeze through <u>capillaries</u> ✓ small, for short diffusion pathway / to fit through <u>capillaries</u> ✓ transport proteins in plasma membrane, to allow chloride shift ✓ high concentrations of carbonic anhydrase (inside cells), to allow transport of carbon dioxide / described ✓		included omitting 'bi' from 'biconcave' and describing the lack of a nucleus as giving more space for oxygen (rather than haemoglobin). Some candidates lost marks for linking an adaptation to the wrong benefit, especially biconcave with being able to fit through capillaries, rather than increasing surface area.
		iii	**FIRST CHECK ON ANSWER LINE** **If answer = 13 award 2 marks** 10 mm / 800 (= 0.0125mm) ✓ 0.0125mm × 1 000 (= 12.5μm) ✓	2(AO2.8)	**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 × 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** **<u>Examiner's Comments</u>** About half of candidates gained the full 2 marks for this question. Marks were most often lost for measuring in cm then an incorrect conversion to micrometres – most multiplying by 1000 rather than 10,000. Candidates who showed working, including the measurement of the diameter with units divided by 800, could access 1 mark even if their final answer was incorrect.

	b	i	digests / hydrolyses / destroys / kills / breaks down, pathogens ✓	1(AO1.1)	**IGNORE** 'get rid of pathogens' **IGNORE** ref to antigens **ALLOW** ref to parasites / damaged cells / tumour cells / old cells / old organelles for 'pathogens' **DO NOT ALLOW** 'engulf pathogens' **Examiner's Comments** Most candidates gained this mark. The most common reason for losing the mark was suggesting that the lysosome engulfed the pathogen, rather than the phagocyte engulfing it, or for suggesting that lysosomes are enzymes. Very few candidates gave acceptable alternatives to pathogens, such as damaged or old cells, rather giving vague answers such as breaking down molecules.
		ii	**FIRST CHECK ON ANSWER LINE** **If answer = 2×10^{-5} award 2 marks** $1.3 \times 10^{-21} / 6.5 \times 10^{-14} = 2 \times 10^{-8}$ (mol cm^{-3}) ✓ 2×10^{-8} (mol cm^{-3}) × $1000 = 2 \times 10^{-5}$ (mol dm^{-3}) ✓	2(AO2.2)	**ALLOW** 0.00002 for 2 marks **ALLOW** '× 1000' seen anywhere in the answer **Examiner's Comments** Few candidates scored both marks for this question. Many candidates did not convert cm^3 into dm^3 or divided the numbers the wrong way round. Often incorrect answers were from not multiplying 2×10^{-8} by 1000 giving the final answer as 2×10^{-8}. Subsequently many candidates achieved ECF for 2biii and 2biv.
		iii	(−log 0.00002 =) 4.7 ✓	1(AO2.2)	**This mark is for a correct calculation**, therefore **ALLOW ECF** from part (ii) if the pH value calculated is given to 2 sig figs, even if outside the normal pH range, including correctly calculated negative values **Examiner's Comments** This mark was for a correct calculation, therefore ECF from Question 2 (b) (ii) was allowed, even if outside the normal pH range, including correctly calculated negative values. Many candidates did not have an awareness of physiological pH values or that a pH>14 or <0 was not plausible which may have helped them revisit 2bii. A small number of candidates recorded to 2 decimal places rather than 2 significant figures.

					OCR support Advice on using calculators to find logarithm functions for maths skill M0.5 can be found on page 16 of the Biology mathematical skills handbook on this page: https:/www.ocr.org.uk/qualifications/as-and-a-level/biology-a-h020-h420-from-2015/planning-and-teaching/ A tutorial, quiz sheet and teacher answers are available here under M0.5. https:/www.ocr.org.uk/subjects/science/maths-for-biology/arithmetic-and-numerical-computation/
		iv	B ✓	1(AO3.1)	**Apply ECF from part (iii)** **ALLOW** B if calculated pH is less than 7 **ALLOW** A if calculated pH is greater than 7 **ALLOW** C if calculated pH is 7. **ALLOW** B if no pH calculation given in (iii) **ALLOW** answer if shown on table if no answer given on answer line **Examiner's Comments** Again, an ECF was allowed from Question 2 (b) (iii). A common error by candidates was the selection of C for pH values just above or below a neutral pH, recorded between 6.7 and 7.7.
	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(AO3.3)(AO3.4)	**ALLOW** iodine for iodide **Examiner's Comments** Some candidates did not take into consideration all the details provided in the question and lost all marks. A few responses lost the marks by talking about different types of microscopes. Most gained 1 mark overall. A common error was for implying crystal violet and iodine should be applied at the same time, rather than one followed by the other. The second mark was often lost for not including the use of safranin and believing that bacteria with thin walls would still be visible without a stain.
			Total	**13**	

<table>
<tr>
<td>12</td><td></td><td>i</td><td>(position / arrangement, of) chromosomes visible ✓</td><td>1
(AO2.7)</td><td>ALLOW chromosomes, different colour to cytoplasm / contrast with rest of cell / show up / stand out, for ‘visible’
ALLOW to, identify / distinguish, chromosomes
ALLOW ORA ‘otherwise we could not see chromosomes’
ALLOW chromatids / genetic material / DNA / chromatin, for ‘chromosomes’

<u>Examiner’s Comments</u>

Most candidates realised that staining made the chromosomes visible.</td>
</tr>
<tr>
<td></td><td></td><td>ii</td><td>chromosomes lined up at, equator / metaphase plate ✓</td><td>1
(AO3.1)</td><td>ALLOW middle (of cell) for ‘equator’
ALLOW pairs of sister chromatids for ‘chromosomes’

<u>Examiner’s Comments</u>

Most candidates described the chromosomes lining up at the equator of the cell as showing metaphase.</td>
</tr>
<tr>
<td></td><td></td><td>iii</td><td>all columns with informative headings ✓

stages of mitosis in correct order ✓</td><td>2
(AO3.2)</td><td>IGNORE data in table.
<table>
<tr><th rowspan="2">Stage (of mitosis)</th><th colspan="3">Number of cells (counted)</th></tr>
<tr><th>Student 1</th><th>Student 2</th><th>Student 3</th></tr>
<tr><td>Prophase</td><td>3</td><td>5</td><td>2</td></tr>
<tr><td>Metaphase</td><td>1</td><td>0</td><td>5</td></tr>
<tr><td>Anaphase</td><td>3</td><td>4</td><td>0</td></tr>
<tr><td>Telophase</td><td>0</td><td>1</td><td>3</td></tr>
</table>
OR
<table>
<tr><th rowspan="2">Student</th><th colspan="4">Number of cells (at stage of mitosis)</th></tr>
<tr><th>Prophase</th><th>Metaphase</th><th>Anaphase</th><th>Telophase</th></tr>
<tr><td>1</td><td>3</td><td>1</td><td>3</td><td>0</td></tr>
<tr><td>2</td><td>5</td><td>0</td><td>4</td><td>1</td></tr>
<tr><td>3</td><td>2</td><td>5</td><td>0</td><td>3</td></tr>
</table>
ALLOW Trial / test, for ‘Student’
ALLOW Amount for ‘Number’
ALLOW Phase for ‘Stage’
ALLOW student 1, student 2, student 3 on left in 2nd table

<u>Examiner’s Comments</u>

Very few candidates were able to design an appropriate table. Too frequently candidates were not providing informative column headings, not giving all the required information within the table itself, not enclosing the table in a box (or the box provided) and not showing the stages of</td>
</tr>
</table>

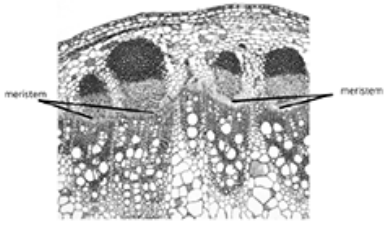
mitosis in the correct order. Candidates should be encouraged to draw tables for their results from class practical experiments rather than relying on pre-printed worksheets to fill in the data. The table on page 4 of the exam paper could have been taken as a model for the task; in this example the dependent variable column was subdivided to show three trials in the same way that 'number of cells in each stage' results from three students needed to be plotted in Question 2 (b) (iii). The published mark scheme shows two ways of arranging the table, with the top version being a better match to the principle of putting the independent variable in the left-hand column. The principles of drawing a table are shown in the checklist below.

OCR support

This checklist for producing tables can be found in the 'Learner Checklist: Graphs, Tables and Drawings' here: https:/www.ocr.org.uk/qualifications/as-and-a-level/biology-a-h020-h420-from-2015/planning-and-teaching/

1	All raw data in a single table with ruled lines and border.	
2	Independent variable (IV) in the first column; dependent variable (DV) in columns to the right (for quantitative observations) OR descriptive comments in columns to the right (for qualitative observations).	
3	Processed data (e.g. means, rates, standard deviations) in columns to the far right.	
4	No calculations in the table, only calculated values.	
5	Each column headed with informative description (for qualitative data) or physical quantity **and** correct units (for quantitative data); units separated from physical quantity using either brackets or a solidus (slash).	
6	No units in the body of the table, only in the column headings.	

					<table><tr><td>7</td><td>Raw data recorded to a number of decimal places appropriate to the resolution of the measuring equipment.</td><td></td></tr><tr><td>8</td><td>All raw data of the same type recorded to the same number of decimal places.</td><td></td></tr><tr><td>9</td><td>Processed data recorded to up to one significant figure more than the raw data.</td><td></td></tr></table>
			Total	**4**	
13		i	phagocyte / neutrophil ✓	1 (AO1.1)	**ALLOW** (non-human) macrophage **IGNORE** leucocyte / white blood cell **Examiner's Comments** Many candidates named the cell correctly as phagocyte or neutrophil. Macrophage was accepted although in humans, macrophages are larger than this cell (the diameter of which was calculated in part (ii)). The most frequently written incorrect response was the general term 'white blood cell'.
		ii	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 14 or 15 (µm) award 2 marks** 14mm ÷ 950 = 0.0147mm ✓ 0.0147 × 1000 = 15µm ✓	2 (AO2.8)	**ALLOW** answer given to **3 significant figures for 2 marks** e.g. 13.7 / 14.2 / 14.7µm If answer given to **more than 3** sig. fig. **max 1 mark** **ALLOW** (13 000 ÷ 950) = 13.7µm **for 2 marks** **ALLOW** (13 500 ÷ 950) = 14.2µm **for 2 marks** If final answer incorrect **award 1 mark** for **two clearly shown** correct steps in working (other than 1 plus 4). **IGNORE** crossed-out working. **steps in working**: **1** (diameter with units =) 13 / 13.5 / 14mm **OR** 1.3 / 1.35 / 1.4cm **2** divide by 950 **3** convert **EITHER** original diameter **OR** answer to µm (mm → µm × 1000, cm → µm × 10 000) **4** round to 2 significant figures **Examiner's Comments** Candidates seemed well-prepared in terms of knowing the equation: $\text{magnification} = \frac{\text{image size}}{\text{object size}}$

					(although, not all could rearrange it). Many were given 1 mark for measuring the cell correctly and stating the length with units in their working and for dividing by the magnification, 950. Where many ran into problems was in converting their answer to micrometres and giving the answer to an appropriate number of significant figures (the same number as the original measurement or one more than that). Many answers were out by a factor of 10 because the candidate measured in centimetres and then multiplied by 1000 instead of 10 000 to convert to micrometres. A simple protocol for performing this calculation is shown below. **Checklist for calculating the diameter of a cell in a photomicrograph** • Measure in **millimetres** • **Multiply by 1000** to convert this measurement to micrometres • **Divide** by the magnification • Round answer to **same** number of significant figures as the original measurement (or **one more**).
		iii	made up of different cells / not made up of different tissues ✓	1 (AO1.1)	**IGNORE** differentiated cells **ALLOW** two or more named blood cells for 'different' **<u>Examiner's Comments</u>** Only a minority of candidates explained that blood is made up of different cells but not different tissues. Although the different cell types were visible in the photomicrograph many candidates wrote that blood consisted of similar cells carrying out a similar function.
			Total	**4**	
14		i	meristem correctly identified ✓ ruler used **and** no arrow on label ✓	2	 **ALLOW** any **one** of the four areas

					Examiner's Comments Relatively few candidates gained credit here. Most were unable to identify the correct area of the image as meristem, possibly because they were confused by the sclerenchyma. Many candidates also did not use a ruler for the label line or added an arrowhead. **OCR support** Guidance on how to correctly label images is given in the drawing skills handbook available at: https:/www.ocr.org.uk/Images/251799-biology-drawing-skills-handbook.pdf
		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 **Examiner's Comments** A good proportion of candidates knew that a light microscope was used and gave valid reasons for their choice. However, a high proportion of candidates suggested that an electron microscope was used and suggested that organelles were visible. This suggests that they have had little experience of viewing specimens with a light microscope and/or interpreting photomicrographs and electron micrographs. Candidates must be able to use the evidence provided for them. **Assessment for learning**

					Biology is a practical subject. It is essential that candidates have the opportunity to view and interpret slides and make biological drawings along with many other practical tasks.
			Total	**5**	