



ANSWER BOOK

Microscopy: magnification, resolution and what you can trust

Cells, microscopy and biological organisation · Unit B01

AQA 3.2.1.1 · OCR A 2.1.1 (a)–(c) · Edexcel A Topic 3.1 · CAIE 1.1

6 questions · 20 marks

NAVY EDITION

SECTION A · Short, 1 to 2 marks

- A1** **B1** magnification is how many times larger the image is than the actual object, [2]
and is a ratio with no units. **B1** resolution is the minimum distance between two points
at which they can still be distinguished as separate.
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SECTION B · Standard, 3 to 5 marks

- B1** **M1** 4 stage micrometer divisions correspond to $4 \times 10 = 40 \mu\text{m}$. **M1** one [4]
eyepiece division is worth 40 divided by 25. **M1** = $1.6 \mu\text{m}$ per eyepiece division, then
multiplied by the 15 divisions the cell covers. **A1** a final answer of $24 \mu\text{m}$.
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- B2** **B1** resolution is limited by the wavelength of the radiation used to illuminate [4]
the specimen. **B1** a beam of electrons has a far shorter wavelength than visible light, so
points much closer together can still be seen as separate. **B1** the electron beam has to
travel through a vacuum, because air molecules deflect electrons and scatter the
beam. **B1** a vacuum removes the water from a cell, so the specimen must be dead,
fixed and dehydrated before it is put in.
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- B3** **B1** a transmission instrument needs an ultrathin section, whereas a scanning [4]
instrument takes a whole specimen coated in a thin film of metal. **B1** a transmission
instrument detects electrons that have passed through the specimen, whereas a
scanning instrument detects electrons knocked off its surface. **B1** a transmission
instrument gives a two-dimensional image of a section, whereas a scanning
instrument gives a three-dimensional image of a surface. **B1** a transmission instrument
resolves to about 0.1 nm, which is better than the few nanometres a scanning
instrument manages.
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- B4** **M1** actual size = image size divided by magnification. **M1** converts 5 mm to 5 [3]
000 000 nm before dividing, or works consistently in another single unit. **A1** an answer of
25 nm, which is the expected size for a ribosome.
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- B5** **B1** the micrograph is one thin section through a three-dimensional cell, so [3]
each organelle is seen only where the knife happened to cut it. **B1** a mitochondrion cut
across appears as a small circle and one cut along its length as a long sausage, so the
same organelle gives different profiles. **B1** a bent organelle can be caught by the knife
twice, so one mitochondrion appears as two separate profiles and the number is
overcounted.
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