

B2.2 Size of specimens

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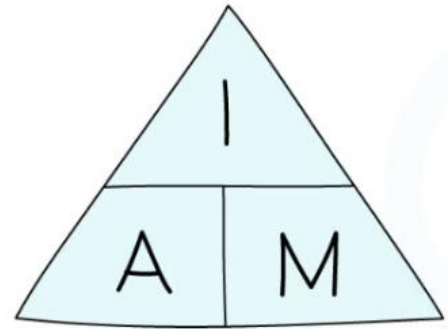
- 1 State and use the formula: magnification = actual size / image size
 - 2 Calculate magnification and size of biological specimens using millimetres as units
 - 3 Convert measurements between millimetres (mm) and micrometres (μm)
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The Magnification Formula

Magnification = Image size $\div$ Actual size

Rearranged versions:

- Magnification (M) = Image size $\div$ Actual size
- Image size (I) = Magnification $\times$ Actual size
- Actual size (A) = Image size $\div$ Magnification



Key points

- Magnification has NO units — it is a ratio, written e.g. $\times 100$ or $\times 400$.
- Image size and actual size MUST be in the SAME units before calculating magnification.
- If a question gives sizes in different units, convert them to match BEFORE using the formula.

Calculating Magnification and Size (using mm)

Worked Example: Finding magnification

An onion cell has an actual length of 0.05 mm. In a drawing, the cell measures 25 mm.

$$M = \text{Image size} \div \text{Actual size} = 25 \div 0.05 = 500$$

Answer: Magnification = $\times 500$

Worked Example: Finding actual size

A drawing of a plant cell is 40 mm wide. The magnification is $\times 200$.

$$A = \text{Image size} \div \text{Magnification} = 40 \div 200 = 0.2 \text{ mm}$$

Answer: Actual size = 0.2 mm

Worked Example: Finding image size

A specimen has an actual size of 0.1 mm and is magnified $\times 300$.

$$I = \text{Actual size} \times \text{Magnification} = 0.1 \times 300 = 30 \text{ mm}$$

Answer: Image size = 30 mm

Tips for exam questions

- Measure the image carefully with a ruler (usually in mm) if a scale bar or diagram is given.
- Show your working — write the formula, substitute numbers, then give the answer with correct units.
- Check your answer is sensible: actual size of a cell should almost always be very small (fractions of a mm), while image size in a diagram is usually much larger (mm to cm range).
- Watch for scale bars: if a scale bar represents, e.g., 10 μm and measures 20 mm on the page, use this to work out the magnification of the whole image first.

Converting Between Millimetres (mm) and Micrometres (μm)

1 mm = 1000 μm

Converting mm $\rightarrow$ μm

Multiply by 1000

Example: 0.05 mm = $0.05 \times 1000 = 50 \mu\text{m}$

Converting $\mu\text{m} \rightarrow$ mm

Divide by 1000

Example: 250 $\mu\text{m} = 250 \div 1000 = 0.25 \text{ mm}$

Always check the units the question asks for in the final answer — convert if needed, and don't lose marks by mixing mm and μm in a calculation.

Show clear working (formula $\rightarrow$ substitution $\rightarrow$ answer with units).

Combined Worked Example (magnification + conversion)

A bacterium has an actual length of 2 μm . In a micrograph, it appears 8 mm long.
Calculate the magnification.

Step 1: Convert to same units.

$$2 \mu\text{m} = 2 \div 1000 = 0.002 \text{ mm}$$

Step 2: Apply the formula.

$$M = 8 \div 0.002 = 4000$$

Answer: Magnification = $\times 4000$

Exam Mistake to Avoid

Confusing which value is "image" vs "actual" — actual size is always the real size of the specimen; image size is what you measure on the page/photo.