

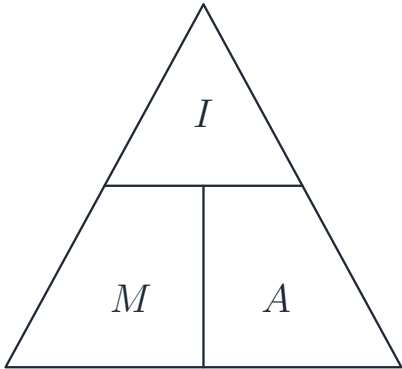
Exercise walk-through

2.2

Size of specimens

IGCSE Biology

Magnification



I = image size

M = magnification

A = actual size

$$M = \frac{I}{A}$$

cover a letter to get its formula

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$

Example ($\times 250$)

image 5.00 mm $\rightarrow$ actual
 $= 5.00 / 250 = 0.02 \text{ mm} = 20 \mu\text{m}$

image = size in the drawing; actual = real
 size of the **specimen** . 1 mm
 $= 1000 \mu\text{m}$.

Cover the quantity you want in the triangle to read off its formula

Changing units (Supplement)

Cells are often measured in **micrometres** (μm), which are smaller than millimetres (mm):

$$1 \text{ mm} = 1000 \mu\text{m}, \quad 1 \mu\text{m} = 0.001 \text{ mm}$$

- mm $\rightarrow$ μm : **multiply** by 1000
- μm $\rightarrow$ mm: **divide** by 1000

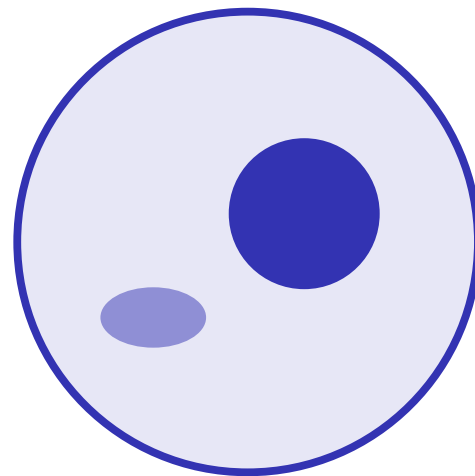
A cell is drawn 60 mm wide and its real width is 30 μm . Find the magnification.

- Make the units match first: image
 $= 60 \text{ mm} = 60 \times 1000 = 60\,000 \mu\text{m}$.
- magnification = image $\div$ actual
 $= 60\,000 \div 30 = \times 2000$.
- Forget to convert and $60 \div 30$ gives $\times 2$ – a thousand times too small.

Converting to one unit before dividing is the single most common mistake in this topic.

Check yourself

- 1 Which three parts does a plant cell have but an animal cell not?
- 2 What holds a bacterium's DNA?
- 3 Where in a cell does respiration happen?
- 4 A $\times 100$ image is 4 mm – what is the actual size?



Answers 1. cell wall, vacuole, chloroplasts 2. a single loop of DNA (no nucleus)
 3. the mitochondria 4. 0.04 mm

Exercises 2.1·2.2

2.1 Write the formula for magnification.

[1]

2.2 Convert 0.05 mm into μm .

[1]

Exercises 2.1·2.2

2.1 Write the formula for magnification.

[1]

2.1

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}}$$

2.2 Convert 0.05 mm into μm .

[1]

2.2

- 1 mm = 1000 μm

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

Exercise 3.1

3.1 Magnification has the unit:

[1]

☐

A mm

B μm

C no unit

D cm

Exercise 3.1

3.1 Magnification has the unit:

[1]

☐

A mm

B μm

C no unit

D cm

3.1 C

- magnification is a **ratio**, so it has **no unit**
- A, B and D are length units

Exercise 3.2 (a)

3.2 A cell has an actual size of $40\text{ }\mu\text{m}$. It is drawn 20 mm wide.

(a) Convert the actual size to mm.

[1]

Exercise 3.2 (a)

3.2 A cell has an actual size of $40\ \mu\text{m}$. It is drawn 20 mm wide.

(a) Convert the actual size to mm.

[1]

(a)

$$40\ \mu\text{m} = \frac{40}{1000}\ \text{mm} = \mathbf{0.04}\ \text{mm}$$

Exercise 3.2 (b)

3.2 A cell has an actual size of $40\text{ }\mu\text{m}$. It is drawn 20 mm wide.

(b) Calculate the magnification of the drawing.

[2]

Exercise 3.2 (b)

3.2 A cell has an actual size of $40\ \mu\text{m}$. It is drawn 20 mm wide.

(b) Calculate the magnification of the drawing.

[2]

(b)

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}} = \frac{20\ \text{mm}}{0.04\ \text{mm}} = \times \mathbf{500}$$

Exercise 3.3

3.3 A structure is shown at $\times 400$ and its image size is 8.0 mm. Calculate its actual size in μm . [3]

Exercise 3.3

3.3 A structure is shown at $\times 400$ and its image size is 8.0 mm. Calculate its actual size in μm . [3]

3.3

- $\text{actual} = \text{image} / \text{magnification}$

$$\frac{8.0 \text{ mm}}{400} = 0.02 \text{ mm}$$

- $0.02 \times 1000 = \mathbf{20} \mu\text{m}$