

Exercise walk-through

2.1

Cell structure

IGCSE Biology

From cell to organism

cell

the smallest part that can carry out the **life processes**

tissue

a group of cells with **similar structure** working together – muscle tissue, xylem

organ

several different tissues working together to do a job – the heart, or a leaf

organ system

several organs working together – the **digestive system**, which breaks down food

organism

all the organ systems together

The word that separates tissue from organ is **different**: one tissue is one kind of cell, an organ is several kinds of tissue.

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

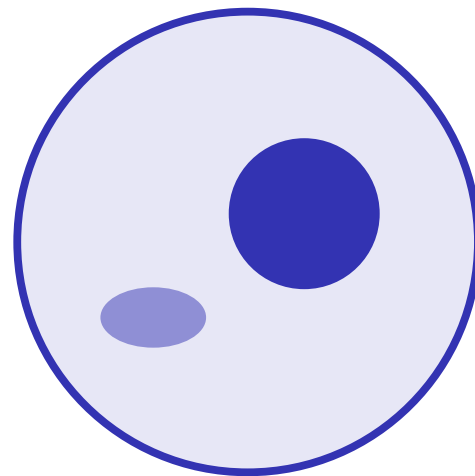
A cell is drawn 60 mm wide and its real width is 30 μm . Find the magnification.

- 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 A student looks at two cells under a microscope. Cell A has a fixed rectangular shape and a large space in the middle; cell B has no fixed shape. Identify which is the plant cell, and name two structures that let you tell. [3]

2.2 State the function of mitochondria. [1]

Exercises 2.1·2.2

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2.1

- Cell A is the **plant cell**
- any **two** of: **cell wall** (fixed shape) / **large vacuole** (space in the middle) / **chloroplasts**

2.2 State the function of mitochondria. [1]

2.2

- mitochondria: where **respiration** happens to **release energy**

Exercises 2.3-2.4

2.3 State the function of the nucleus and of the cell membrane. [2]

2.4 A drawing of a cell is 45 mm long. The real cell is 0.15 mm long. Calculate the magnification. [2]

Exercises 2.3·2.4

2.3 State the function of the nucleus and of the cell membrane. [2]

2.3

- nucleus: holds the DNA and **controls the cell**
- cell membrane: **controls which substances enter and leave**

2.4 A drawing of a cell is 45 mm long. The real cell is 0.15 mm long. Calculate the magnification. [2]

2.4

- magnification = image/actual

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}} = \frac{45 \text{ mm}}{0.15 \text{ mm}} = \times \mathbf{300}$$

Exercises 2.5·3.1

2.5 Explain how a root hair cell is adapted to its function.

[2]

3.1 A cell has no nucleus, but has a cell wall, a loop of DNA and plasmids. It is a: [1]

☐

A plant cell

B animal cell

C bacterial cell

D red blood cell

Exercises 2.5·3.1

2.5 Explain how a root hair cell is adapted to its function.

[2]

2.5

- it has a **long, narrow extension**
- that gives a **large surface area** for absorbing water and mineral ions

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☐

A plant cell

B animal cell

C bacterial cell

D red blood cell

3.1 C

- no nucleus + plasmids + a DNA loop → a **bacterial cell**
- A and B have a nucleus; D is an animal cell without a wall or plasmids

Exercise 3.2 (a)

3.2 A red blood cell is a specialised cell.

(a) State its job.

[1]

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(a) State its job.

[1]

(a)

- a red blood cell **transports oxygen**

Exercise 3.2 (b)

3.2 A red blood cell is a specialised cell.

(b) Explain how having no nucleus suits this job.

[2]

Exercise 3.2 (b)

3.2 A red blood cell is a specialised cell.

(b) Explain how having no nucleus suits this job.

[2]

(b)

- no nucleus leaves more room for **haemoglobin**
- so it can **carry more oxygen**

Exercise 3.3

3.3 Put these in order from smallest to largest: organ, cell, organism, tissue, organ system. [2]

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3.3

- cell → tissue → organ → organ system → organism

Exercise 3.4 (a)

3.4 The diagram in a textbook shows a palisade mesophyll cell from a leaf. The drawing is 80 mm tall and the cell is really 0.10 mm tall.

(a) Calculate the magnification of the drawing.

[2]

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(a) Calculate the magnification of the drawing.

[2]

(a)

$$\text{magnification} = \frac{\text{image size}}{\text{actual size}} = \frac{80 \text{ mm}}{0.10 \text{ mm}} = \times \mathbf{800}$$

Exercise 3.4 (b)

3.4 The diagram in a textbook shows a palisade mesophyll cell from a leaf. The drawing is 80 mm tall and the cell is really 0.10 mm tall.

(b) The same drawing shows a chloroplast 4 mm across. Calculate the real width of the chloroplast, in micrometres. [3]

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(b)

- actual size = image/magnification

$$\frac{4 \text{ mm}}{800} = 0.005 \text{ mm}$$

- $0.005 \times 1000 = 5 \text{ } \mu\text{m}$

Exercise 3.4 (c)

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(c) Complete the table by naming the structure that carries out each function. [4]

Function	Structure
controls what enters and leaves the cell	
site of aerobic respiration	
absorbs light energy for photosynthesis	
gives the plant cell its fixed shape	

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(c)

- cell membrane; mitochondrion; chloroplast; cell wall

Exercise 3.4 (d)

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(d) A bacterial cell is examined. Identify two structures present in the palisade cell that the bacterial cell does not have, and name the structure that carries the bacterial cell's genetic material.

[3]

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(d)

- any **two** of: nucleus / mitochondria / chloroplasts / permanent vacuole
- bacterial genetic material: a **loop of DNA**, plus **plasmids**

Exercise 3.4 (e)

3.4 The diagram in a textbook shows a palisade mesophyll cell from a leaf. The drawing is 80 mm tall and the cell is really 0.10 mm tall.

(e) Explain how the palisade cell's position and its number of chloroplasts suit its function. [2]

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(e)

- it sits near the **top of the leaf**, where the light is strongest
- many chloroplasts absorb as much light as possible for **photosynthesis**