

Organisation of the organism

IGCSE Biology 0610 · Topic 2 revision notes

Everything from the 3 lessons of this topic on a few pages: the key idea of each lesson, the diagram to remember, the points to learn and the traps examiners set. Read it, cover it, test yourself.

1. Animal, plant and bacterial cells

2. Specialised cells and levels of organisation

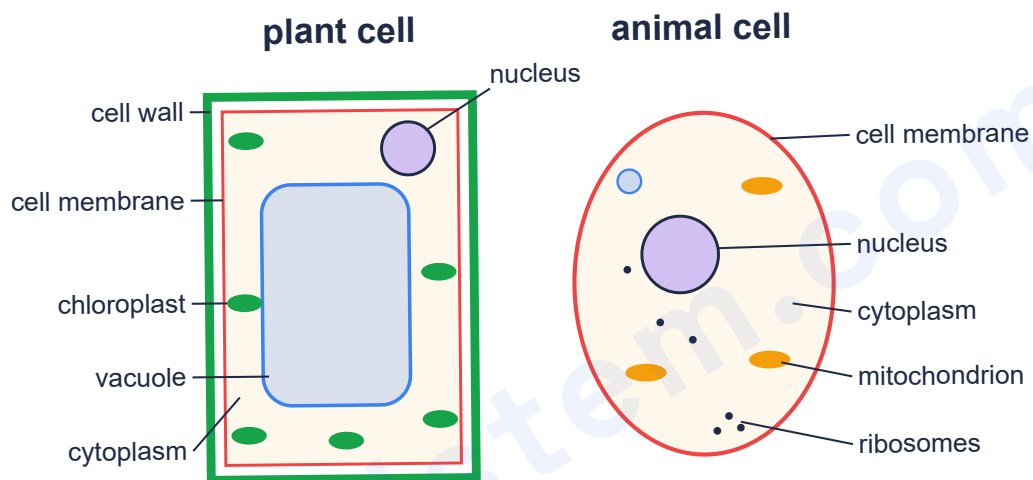
3. Magnification and size of specimens

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1 Animal, plant and bacterial cells

Syllabus 2.1

Animal and plant cells both have a cell membrane, cytoplasm, a nucleus, mitochondria and ribosomes. Plant cells also have a cellulose cell wall, a large permanent vacuole and, in parts exposed to light, chloroplasts. A bacterial cell has a cell wall, cell membrane, cytoplasm and ribosomes, but no nucleus: its genetic material is a loop of circular DNA, and it may also carry small rings of DNA called plasmids.



plant cells only: cell wall, chloroplasts, large permanent vacuole

both: membrane, cytoplasm, nucleus, mitochondria, ribosomes

Fig. 1: a plant cell and an animal cell, with the structures each one contains

Shared parts first, extras second.

- ✓ **All three cell types:** cell membrane, cytoplasm and ribosomes.
- ✓ **Plant cells add:** cellulose cell wall, chloroplasts and a large permanent vacuole.
- ✓ **Bacteria:** no nucleus; circular DNA and plasmids instead; a cell wall that is not cellulose.
- ✓ **Function words:** controls entry and exit (membrane), protein synthesis (ribosomes), aerobic respiration (mitochondria).

Watch out!

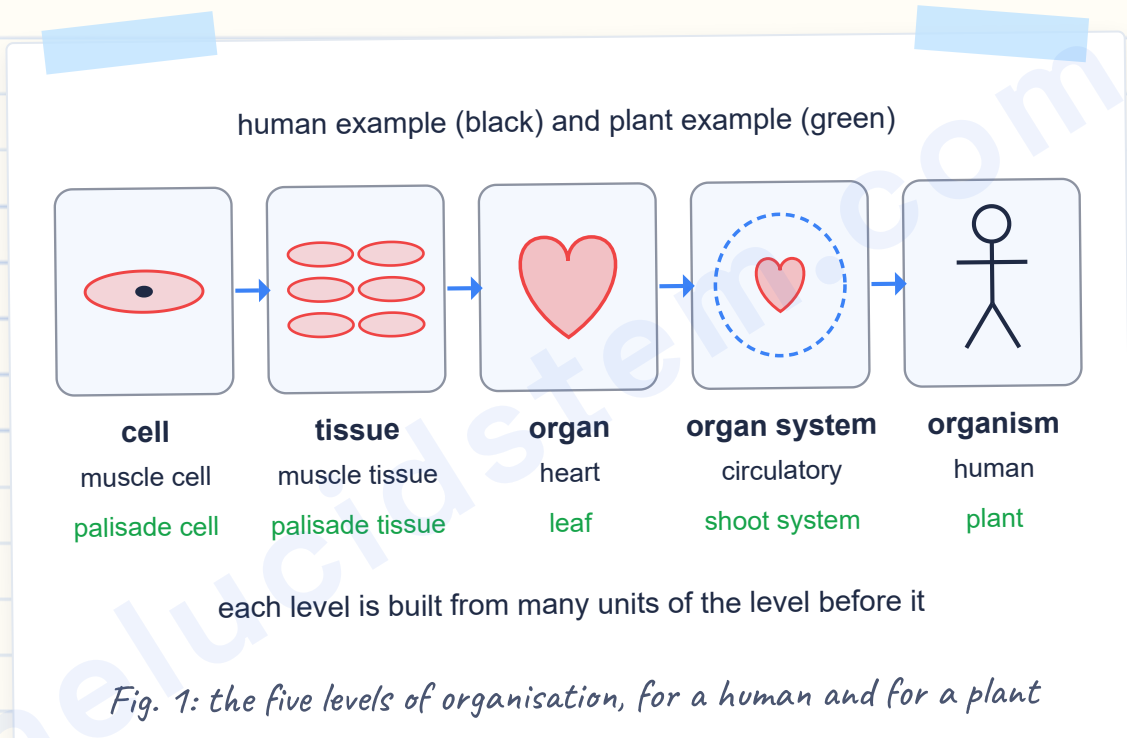
Plant cells have mitochondria as well as chloroplasts. Chloroplasts do not replace mitochondria: plant cells respire all the time, day and night, so a palisade cell contains both. Not every plant cell has chloroplasts either: root cells and onion bulb cells are not exposed to light and have none.

A label line must touch the structure you name. A line ending in the vacuole but labelled cytoplasm, or ending on the thick outer line of a plant cell but labelled cell membrane, scores no mark.

2 Specialised cells and levels of organisation

Syllabus 2.1

New cells are produced by division of existing cells. Specialised cells have specific functions: ciliated cells move mucus in the trachea and bronchi, root hair cells absorb water and mineral ions, palisade mesophyll cells photosynthesise, neurones conduct electrical impulses, red blood cells transport oxygen, and sperm and egg cells (gametes) are for reproduction. Similar cells form a tissue, tissues form an organ, organs form an organ system, and organ systems together form an organism.



Structure always explains function.

- ✓ **New cells** come only from the division of existing cells.
- ✓ **Seven specialised cells:** ciliated, root hair, palisade mesophyll, neurone, red blood cell, sperm and egg.
- ✓ **Link a feature to a job:** large surface area for absorption, chloroplasts for photosynthesis, no nucleus for more haemoglobin.
- ✓ **Levels:** cell, tissue (similar cells), organ (several tissues), organ system (several organs), organism.

Watch out!

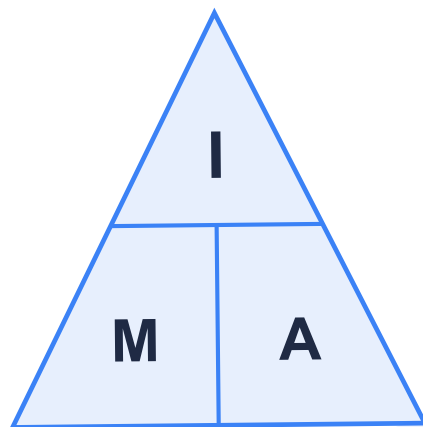
Learn the function in the syllabus words. A red blood cell's function is the **transport of oxygen**, not just carrying blood; a ciliated cell **moves mucus**, it does not trap dust itself (the mucus, made by other cells, does the trapping).

An organ contains **several different tissues**; a tissue is made of **similar cells**. A leaf is an organ (epidermis, palisade and spongy mesophyll, xylem and phloem tissues), not a tissue. The heart is an organ, not an organ system: it is one part of the circulatory system.

3 Magnification and size of specimens

Syllabus 2.2

magnification = image size $\div$ actual size. Rearranged, actual size = image size $\div$ magnification, and image size = magnification $\times$ actual size. Measure the image with a ruler in millimetres and put both sizes in the same unit before dividing. Magnification has no unit; it is written as $\times 600$, for example. Extended: 1 mm = 1000 μm , so multiply by 1000 to go from mm to μm and divide by 1000 to go from μm to mm.



I = image, M = magnification,
A = actual size

$$M = I \div A$$

$$A = I \div M$$

$$I = M \times A$$

palisade cell drawing:

image = 36 mm

actual = 0.06 mm

$$M = 36 \div 0.06 = \times 600$$

$$1 \text{ mm} = 1000 \mu\text{m}$$

Fig. 1: the magnification triangle, with a worked example

Same units, then divide.

- ✓ **$M = I \div A$** ; rearranged, $A = I \div M$ and $I = M \times A$.
- ✓ **Measure the image in mm**: 1 cm = 10 mm.
- ✓ **Extended**: 1 mm = 1000 μm ; convert both sizes to the same unit before dividing.
- ✓ **Magnification has no unit**: write $\times 600$, and check the actual size is smaller than the image.

Watch out!

Measure the image in **millimetres**, not centimetres. A drawing 3.6 cm long is 36 mm. Using 3.6 with an actual size in mm gives a magnification ten times too small.

Never divide a size in mm by a size in μm . Dividing 40 mm by 8 μm as if they were the same unit gives $\times 5$, a thousand times too small. Convert both sizes to the same unit first.