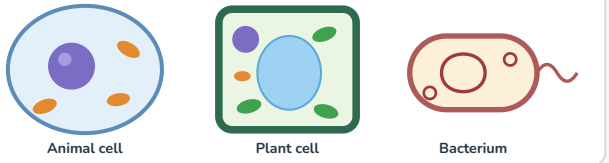
Cell Biology

AQA 8461 · Edexcel 1BI0 · OCR J247 / J257

1 Eukaryotes & prokaryotes

Chunk 1



● nucleus ● mitochondria ● chloroplasts ● permanent vacuole
▬ cell wall ○ DNA loop · plasmids (not to scale)

Eukaryotic (plant, animal): DNA enclosed in a nucleus. **Prokaryotic** (bacteria): much smaller, DNA is a loop plus plasmids, **no nucleus**.

2 Structures & functions

Chunk 2

Structure	Function
Nucleus	holds DNA; controls the cell
Cytoplasm	gel where reactions happen
Cell membrane	controls what enters / leaves
Mitochondria	aerobic respiration (energy)
Ribosomes	protein synthesis
Chloroplasts plant	photosynthesis
Permanent vacuole plant	cell sap; keeps cell rigid
Cell wall plant	cellulose; strengthens the cell

3 Specialised cells

Chunk 3

Cell	Adaptation → job
Sperm	streamlined, tail → swims to egg
Nerve	long axon → carries impulses
Muscle	can contract → moves bones, organs
Root hair	long thin extension → surface area
Xylem	hollow thick tube → water, support
Phloem	tube + companion cell → sugars

Differentiation: the cell gains the structures for one job. Most animal cells differentiate **early**; many plant cells **throughout life**.

4 Which cell has what?

Chunks 1 & 2

Structure	Animal	Plant	Bacterium
Nucleus	✓	✓	×
Cell membrane · cytoplasm · ribosomes	✓	✓	✓
Mitochondria	✓	✓	×
Chloroplasts · permanent vacuole	×	✓	×
Cell wall	×	✓ **cellulose**	✓
Chromosomal DNA loop + plasmids	×	×	✓
Flagella	×	×	**often**

Plant cells **do** have mitochondria: chloroplasts make food, mitochondria still release the energy.

5 Microscopes & magnification

Chunks 4 – 6

	Light	Electron
Magnification	lower (to ~×2000)	much higher
Resolution	lower	much higher

Magnification = how much bigger. **Resolution** = the ability to distinguish between two points that are close together (how much fine detail you can see).

1 Same unit mm → µm ×1000 · µm → nm ×1000 › **2 Divide** **magnification = image ÷ real size** › **3 Check** unit written · answer > 1

Prefixes: milli $\times 10^{-3}$ · micro $\times 10^{-6}$ · nano $\times 10^{-9}$ (Edexcel also pico $\times 10^{-12}$).

Total magnification = eyepiece × objective lens (a different calculation).

AQA RP1 · observing cells: thin specimen · stain (iodine for plant, methylene blue for animal) · lower the coverslip at an angle · lowest power first · pencil drawing, no shading, **scale bar labelled with the real length**.

6 Mitosis & the cell cycle

Chunk 7

1 Grow DNA copied › **2 Nucleus** divides › **3 Cytoplasm** divides

→ 2 genetically identical daughter cells

- **Used for:** growth, repair, replacing cells, asexual reproduction. Human body cell: 23 pairs of chromosomes.

AQA / OCR: the three broad stages only.

Edexcel: interphase → prophase → metaphase → anaphase → telophase → cytokinesis.

7 Stem cells

Chunk 8

Source	Can become
Embryo	most human cell types
Adult bone marrow	many types, e.g. blood cells (more limited)
Plant meristem	any plant cell, throughout life

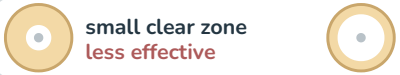
- **Medical:** diabetes, paralysis. **Risk:** viral infection. Ethical objections (embryos). Evaluate **both** sides.
- **Plants:** clone rare species; mass-produce disease-resistant crops.

AQA: therapeutic cloning: the patient's own genes, so no rejection.

8 Bacteria & RP2

Chunks 12–13 · Biology only

- **Binary fission** as often as every 20 min. Number = 2^n (n divisions): 2 divisions → $2^2 = 4$.
- **Aseptic technique:** sterilise dishes & media · flame the loop · tape lid (not sealed) · store upside down.
- **Max 25 °C** in school: fewer human pathogens.
- **AQA RP2:** discs on an agar plate; clear **zone of inhibition** = bacteria killed; bigger zone = more effective.
- **Control disc** soaked in water only. Area = πr^2 (halve the diameter).



9 Transport across membranes

Chunks 9 – 11

	Diffusion	Osmosis	Active transport
What moves	particles of a gas or solute	water only, through a partially permeable membrane	substances, e.g. mineral ions, sugar
Direction	high → low concentration	dilute → concentrated solution	low → high (against the gradient)
Energy?	none (passive)	none (passive)	**yes**, from respiration
Example	O_2 / CO_2 gas exchange; urea cells → blood	AQA RP3: potato cylinders in sugar or salt solutions	ions into root hairs; sugar from gut into blood

Diffusion rate: concentration gradient · temperature · surface area. **Exchange surfaces:** large surface area, thin, blood supply (animals), ventilated: needed because surface area : volume falls as organisms grow. **AQA RP3:** % change in mass = (final – initial) ÷ initial × 100; where the line crosses zero, the solution matches the inside of the tissue.

Edexcel Biology only: Fick's law, rate ∝ (surface area × concentration difference) ÷ thickness.

OCR Gateway: "water potential" used; J257 does not require it.