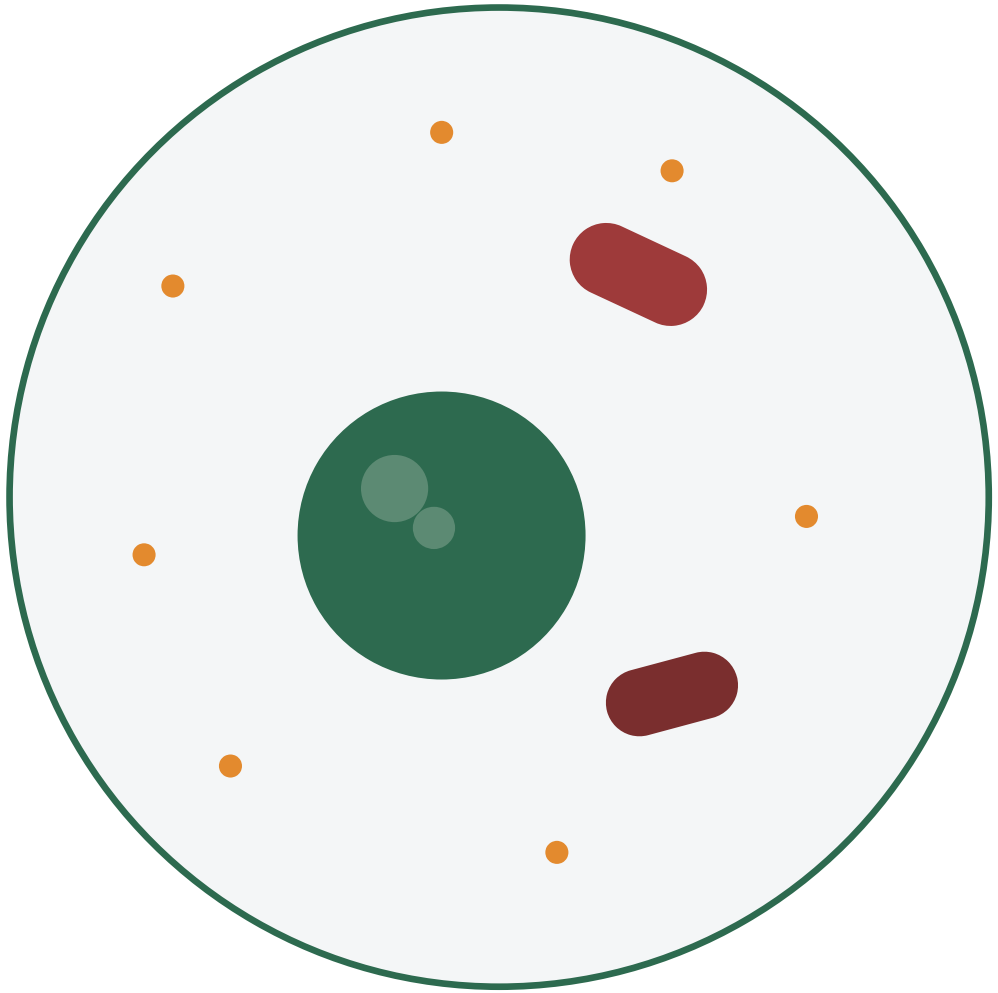
GCSE BIOLOGY · TEACHING DECK

Cell Biology



Teaching Deck 1 of 5 — Cell types and structure

Covers Chunks 1–3: Eukaryotes & prokaryotes · Animal & plant cells · Specialisation

AQA 8461 | Edexcel 1BI0 | OCR J247 / J257

Common to all three boards · Combined Science & separate Biology · every student covers this

Where we're going — 5 teaching decks

THIS DECK

1 Cell types & structure

Chunks 1–3

1 Eukaryotes & prokaryotes

2 Animal & plant cells

3 Specialisation

2 Microscopy & RP1

Chunks 4–6

4 Light vs electron microscopy

5 Magnification maths

6 RP1: observing cells

3 Division & stem cells

Chunks 7–8

7 Mitosis & the cell cycle

8 Stem cells

4 Transport

Chunks 9–11

9 Diffusion

10 Osmosis + RP3

11 Active transport

BIO ONLY

5 Microorganisms

Chunks 12–13

12 Culturing microorganisms

13 RP2: antiseptics/antibiotics

Teaching Deck 1 is the foundation — every structure named here gets reused for the rest of the topic.

Which slides do I need?

Each slide is labelled with the board it is for. Find your board, then skip the slides listed — they are not on your specification.

Your board	Slides to SKIP
AQA	None — every slide applies
EDEXCEL	None — every slide applies
OCR	None — every slide applies

Also: Slide 15 (Structure and function) has an Edexcel side note on sperm, egg and ciliated cells. Every slide applies to every board; board notes just show where your specification asks for more detail.

Before we start — what do you already know?

Answer from memory first. No notes! This is your KS3 science — we build on it all deck.

1. Name three structures you would find in an animal cell.

2. What does the nucleus do?

3. What does the cell membrane do?

STARTER

~1 min

“Bacteria are alive, and so are you — but a bacterial cell is built completely differently from any cell in your body. What's the one difference that matters most?”

Write your ideas in the box — we'll confirm the real dividing line next.

Eukaryotic vs prokaryotic — the one big divide

Eukaryotic cells

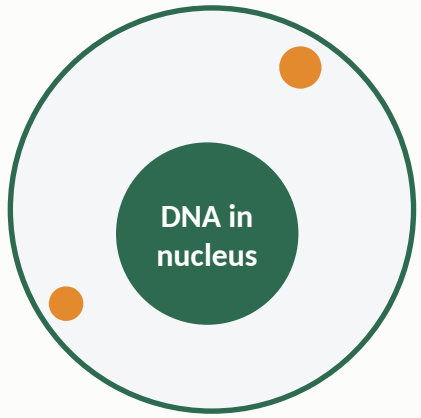
Plant and animal cells. They have a cell membrane, cytoplasm and genetic material enclosed in a nucleus.

Prokaryotic cells

Bacterial cells — much smaller. Cytoplasm and a cell membrane, surrounded by a cell wall, plus ribosomes just like eukaryotic cells. Genetic material is a single loop called chromosomal DNA, not enclosed in a nucleus, plus one or more small rings of DNA called plasmid DNA.

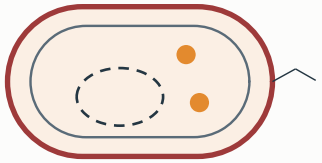
Bacteria also have flagella

Whip-like tails used for movement.



Eukaryotic cell

e.g. animal cell — DNA enclosed in a nucleus

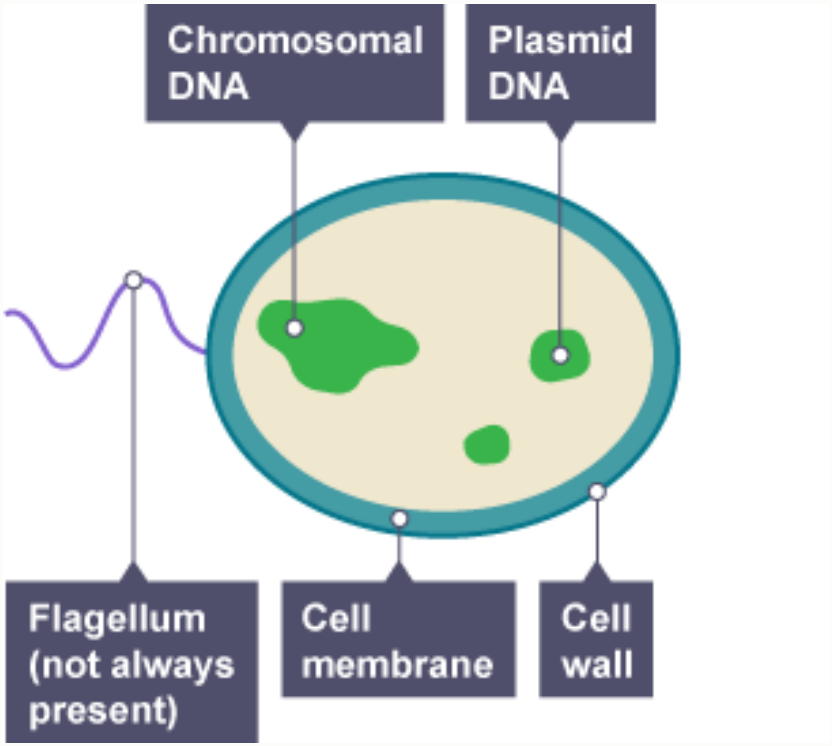


Prokaryotic cell

e.g. bacterium — much smaller, chromosomal DNA free in the cytoplasm

Drawn to the level of detail expected in the exam.

Inside a bacterial cell



Not to scale — a real bacterium is about 1/10th the size of a typical animal cell.

1. **Cell wall**
   Surrounds the membrane; gives the cell its shape and support.
2. **Cell membrane**
   Controls what substances enter and leave the cell.
3. **Cytoplasm**
   Gel-like substance where most chemical reactions happen.
4. **Chromosomal DNA**
   The main genetic material — a single loop, not enclosed in a nucleus.
5. **Plasmid DNA**
   Small extra ring(s) of DNA, separate from the chromosomal DNA.
6. **Ribosomes**
   Site of protein synthesis — bacteria have these too, just like eukaryotic cells.
7. **Flagella**
   Whip-like tail(s) used for movement.

WORKED EXAMPLE

We model the method first — then you try

A student says “prokaryotic cells are just smaller versions of eukaryotic cells.” What's wrong with that statement?

WORKING

1. **It's not just about size.**
   Size alone doesn't capture the structural difference being tested.
2. **Prokaryotic cells lack a nucleus.**
   Their DNA is a free-floating loop, not enclosed in a membrane.
3. **They also lack membrane-bound organelles.**
   No mitochondria, no true nucleus — structures eukaryotic cells rely on.

Answer: Prokaryotic cells lack a nucleus (their DNA is a free-floating loop, not enclosed) and lack the membrane-bound organelles found in eukaryotic cells — it's a structural difference, not just a size difference.

WORKED EXAMPLE

We model the method first — then you try

Compare the structure of a bacterial cell with the structure of an animal cell. (6 marks)

WORKING

1	**Where the DNA is.**	Animal cell: DNA is enclosed in a nucleus. Bacterial cell: a single loop of chromosomal DNA free in the cytoplasm, plus one or more small plasmid rings.
2	**Size and extra structures.**	Bacterial cells are much smaller, have a cell wall, no nucleus and no membrane-bound organelles, and may have flagella for movement.
3	**What they share.**	Both have a cell membrane, cytoplasm and ribosomes.

Answer: In an animal cell the DNA is enclosed in a nucleus, whereas in a bacterial cell it is a single loop of chromosomal DNA free in the cytoplasm, with one or more small plasmid rings as well. Bacterial cells are much smaller, have a cell wall, and lack a nucleus and membrane-bound organelles; they may also have flagella for movement. Both types of cell have a cell membrane, cytoplasm and ribosomes.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Name two structures found in a prokaryotic cell that are not found in a eukaryotic cell.

2. Where is the genetic material found in a bacterial cell, and how does this differ from an animal cell?

3. What is a plasmid?

ANSWERS

Check your own work

1 A cell wall, and one or more plasmids (accept flagella).

2 In a bacterial cell, DNA is a single loop free in the cytoplasm, plus possible plasmids — not enclosed in a nucleus, as it is in an animal cell.

3 A small ring of DNA in a bacterial cell, separate from the main chromosomal DNA loop.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

✖ **"Prokaryotic cells are just smaller eukaryotic cells."** It's structural, not size — no nucleus, no membrane-bound organelles.

✖ **Saying bacterial DNA is "in a nucleus."** It's a free-floating loop in the cytoplasm — bacteria have no nucleus at all.

✖ **Forgetting plasmid DNA is separate from the chromosomal DNA.** Chromosomal DNA and plasmid DNA are two distinct things — name both.

✅ IN A NUTSHELL

- Eukaryotic cells (plant & animal): DNA enclosed in a nucleus.
- Prokaryotic cells (bacteria): much smaller, DNA is a free loop — no nucleus.
- Bacteria also carry plasmid DNA, ribosomes, and often flagella for movement.
- Cell-size calculations (magnification and unit conversion) are common content — full method in Chunk 5.

NEXT Chunk 2 — Animal and plant cells →

STARTER

~1 min

“A plant cell and an animal cell share most of the same parts — but a plant cell has three extra structures an animal cell doesn't. What are they, and why does a plant need them?”

Write your ideas in the box — we'll confirm all three next.

Same core structures, three extras for plants

Most animal cells have:

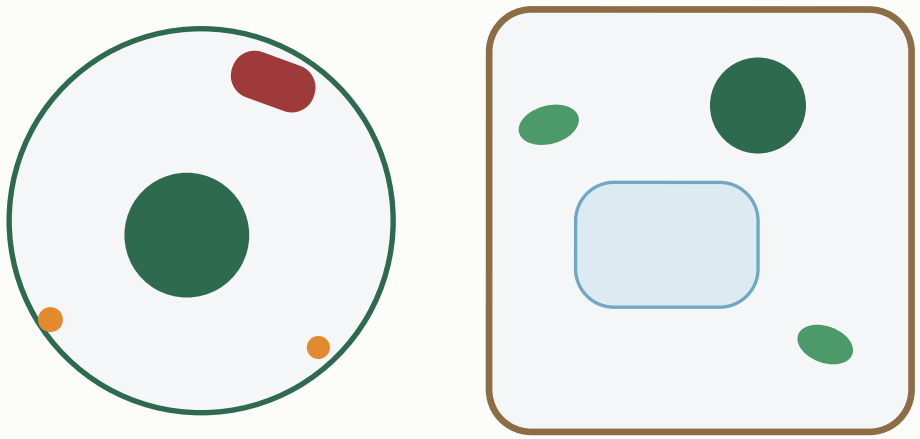
A nucleus, cytoplasm, a cell membrane, mitochondria and ribosomes.

Plant cells add three more:

Chloroplasts and a permanent vacuole filled with cell sap. Plant (and algal) cells also have a cell wall made of cellulose, which strengthens the cell.

Link structure to function

You should be able to explain how nucleus, cell membrane, mitochondria, chloroplasts (plants) and plasmids (bacteria) relate to their function — full table next slide.



Drawn to the level of detail expected in the exam.

Structure and function

Structure	Function
Nucleus	Contains genetic material (DNA) that controls the cell's activities.
Cytoplasm	Gel-like substance where most chemical reactions happen.
Cell membrane	Controls what substances enter and leave the cell.
Mitochondria	Site of (aerobic) respiration, which releases energy.
Ribosomes	Site of protein synthesis.
Chloroplasts (plant only)	Contain chlorophyll; site of photosynthesis.
Permanent vacuole (plant only)	Filled with cell sap; helps keep the cell rigid.
Cell wall (plant only)	Made of cellulose; strengthens the cell.

EDEXCEL: names specialised cells with more structural detail — sperm cells (acrosome, haploid nucleus, mitochondria, tail), egg cells (nutrients in cytoplasm, haploid nucleus) and ciliated epithelial cells, all examinable on Topic 1.

WORKED EXAMPLE

We model the method first — then you try

In a diagram of a cell, the nucleus takes up about a quarter of the total width of the cell. If the cell is roughly 40 µm wide, estimate the width of the nucleus.

WORKING

1	**Read the proportion from the diagram.**	The nucleus looks about a quarter of the cell's total width.
2	**Apply that fraction to the real width.**	A quarter of 40 µm = 40 ÷ 4.
3	**Calculate.**	40 ÷ 4 = 10 µm.

Answer: 10 µm — an estimate from proportion, not a precise measurement, which is exactly the skill being tested.

WORKED EXAMPLE

We model the method first — then you try

Compare a plant cell with an animal cell, and give the function of each structure you mention. (6 marks)

WORKING

1	**Structures both have.**	Nucleus (contains DNA that controls the cell), cytoplasm (reactions happen here), cell membrane (controls what enters and leaves), mitochondria (respiration), ribosomes (protein synthesis).
2	**Extra structures in plants.**	Chloroplasts (contain chlorophyll; photosynthesis), a permanent vacuole (cell sap; keeps the cell rigid) and a cellulose cell wall (strengthens the cell).
3	**The key idea.**	Plant cells add these structures — they do not replace any. Plant cells still have mitochondria.

Answer: Both plant and animal cells have a nucleus, which contains the DNA that controls the cell's activities; cytoplasm, where most reactions happen; a cell membrane, which controls what enters and leaves; mitochondria, the site of respiration; and ribosomes, the site of protein synthesis. Plant cells also have chloroplasts, which contain chlorophyll for photosynthesis, a permanent vacuole filled with cell sap that helps keep the cell rigid, and a cellulose cell wall that strengthens it.

YOUR TURN

Have a go before we check — answers on the next slide.

1. List the structures found in both plant and animal cells.

2. List the three extra structures found in plant cells but not animal cells, and give the function of each.

3. What is the function of mitochondria?

4. A diagram shows a chloroplast taking up about a third of the width of a plant cell. If the cell is roughly 60 µm wide, estimate the width of the chloroplast.

ANSWERS

Check your own work

1 Nucleus, cytoplasm, cell membrane, mitochondria, ribosomes.

2 Chloroplasts (photosynthesis); permanent vacuole (contains cell sap, helps rigidity); cell wall made of cellulose (strengthens the cell).

3 They are the site of respiration, which releases energy for the cell.

4 A third of 60 µm is 60 ÷ 3 = 20 µm.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

✖ **"Plant cells don't have mitochondria."** They do — chloroplasts do photosynthesis, but every cell still needs mitochondria for respiration.

✖ **Naming "cell wall" without "cellulose."** Always name the material — "cellulose cell wall", not just "cell wall".

✖ **Calling the vacuole just "a vacuole."** It's specifically the permanent vacuole, filled with cell sap, for rigidity.

✅ IN A NUTSHELL

- Animal cells: nucleus, cytoplasm, membrane, mitochondria, ribosomes.
- Plant cells add: chloroplasts, permanent vacuole, cellulose cell wall.
- You can estimate a structure's size from its proportion of the whole cell.
- Edexcel (1BI0) also names extra detail for sperm, egg and ciliated cells.

NEXT Chunk 3 — Cell specialisation and differentiation →

STARTER

~1 min

“A sperm cell, a nerve cell and a red blood cell all started out with the same set of instructions (DNA) — so why do they look and behave completely differently?”

Write your ideas in the box — we'll build the vocabulary for this next.

Specialisation — different cells, different jobs

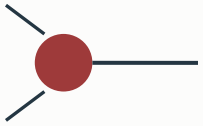
Cells may be specialised to carry out a particular function.

ANIMAL CELLS



Sperm cell

Streamlined with a tail, for swimming to the egg.



Nerve cell

Long extension (axon) to carry electrical impulses.



Muscle cell

Can contract, to move bones or organs.

PLANT CELLS



Root hair cell

Long thin extension, increasing surface area.



Xylem

Hollow, thickened tube — transports water and support.



Phloem

Tube + companion cell — transports dissolved sugars.

Differentiation — how cells get there

Cell differentiation

As an organism develops, cells differentiate to form different types of cell. As a cell differentiates, it acquires different sub-cellular structures to carry out its specific function — it becomes a specialised cell.

Why it matters

Differentiation is what lets one organism build many different, efficient cell types — rather than relying on one generic cell to try to do every job.

Animals vs plants: timing differs

Most animal cell types differentiate early in development. Many plant cell types keep the ability to differentiate throughout life.

In mature animals

Cell division is mainly restricted to repair and replacement, not producing new undifferentiated cells.



Gains new sub-cellular structures suited to one job.

Unseen-context skill: you'll be given a structure and asked how it relates to its function — practise with unfamiliar cells, not just the standard list.

WORKED EXAMPLE

We model the method first — then you try

A root hair cell has a long, thin extension into the soil. How does this relate to its function?

WORKING

1	**Identify the structure.**	A long, thin extension into the soil.
2	**Link it to a measurable property.**	It increases the cell's surface area.
3	**Link that to the function.**	More surface area speeds up water and mineral ion uptake by diffusion and active transport.

Answer: The long extension increases the cell's surface area, which increases the rate of water and mineral ion uptake from the soil by diffusion and active transport.

WORKED EXAMPLE

We model the method first — then you try

Explain what is meant by cell differentiation, and describe how one animal cell and one plant cell are adapted to their functions. (6 marks)

WORKING

1	**Differentiation.**	As an organism develops, cells differentiate: they acquire different sub-cellular structures to carry out a specific function — they become specialised.
2	**An animal cell.**	A sperm cell is streamlined with a tail, for swimming to the egg.
3	**A plant cell.**	A root hair cell has a long, thin extension that increases its surface area, so water and mineral ions are taken up faster.

Answer: Differentiation is the process by which a cell acquires different sub-cellular structures to carry out a specific function, so that it becomes a specialised cell. A sperm cell is streamlined and has a tail, which lets it swim to the egg. A root hair cell has a long, thin extension that increases its surface area, which speeds up the uptake of water and mineral ions from the soil.

YOUR TURN

Have a go before we check — answers on the next slide.

1. What is meant by cell differentiation?

2. Give two examples of specialised animal cells and two examples of specialised plant cells.

3. Why do most types of animal cell differentiate early, while cell division in a mature animal is mostly restricted to repair and replacement?

ANSWERS

Check your own work

1 The process by which a cell acquires different sub-cellular structures to become specialised for a particular function.

2 Animal: any two of sperm cells, nerve cells, muscle cells (ciliated epithelial cells on Edexcel). Plant: root hair cells, xylem cells, phloem cells.

3 Once a cell has become specialised, further division is generally used to repair and replace existing tissue rather than to keep producing new, undifferentiated cells.

Key terms for this deck

Term	Meaning
Eukaryotic cell	Plant and animal cells — genetic material enclosed in a nucleus.
Prokaryotic cell	Bacterial cells — much smaller; DNA is a free loop, not enclosed in a nucleus.
Chromosomal DNA	The main genetic material in a bacterial cell — a single loop.
Plasmid DNA	Small extra ring(s) of DNA, separate from the chromosomal DNA.
Flagella	Whip-like tails used for movement.
Mitochondria	Site of (aerobic) respiration, which releases energy.

Term	Meaning
Ribosomes	Site of protein synthesis.
Chloroplasts	Contain chlorophyll; site of photosynthesis (plant cells only).
Permanent vacuole	Filled with cell sap; helps keep the cell rigid (plant cells only).
Cell wall	Made of cellulose in plant cells; strengthens the cell.
Differentiation	The process by which a cell acquires different sub-cellular structures to become specialised.
Specialised cell	A cell adapted to carry out a particular function.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Using “specialised” and “differentiated” as if they mean the same thing.** Differentiation is the process; specialised describes the cell once it's happened.
- ✖ **Assuming plant cells only differentiate early, like most animal cells.** Many plant cell types can differentiate throughout the plant's life.
- ✖ **Giving a generic answer instead of linking THIS structure to THIS function.** Examiners reward specific reasoning in unseen contexts, not a memorised list.

✅ IN A NUTSHELL

- Specialisation: a cell adapted to carry out a particular function.
- Differentiation: the process of acquiring the structures that make it specialised.
- Most animal cells differentiate early; many plant cells can differentiate throughout life.
- Always link the specific structure given to the specific function — tested in unseen contexts.

NEXT Teaching Deck 2 — Microscopy & RP1 →

GCSE BIOLOGY · TEACHING DECK

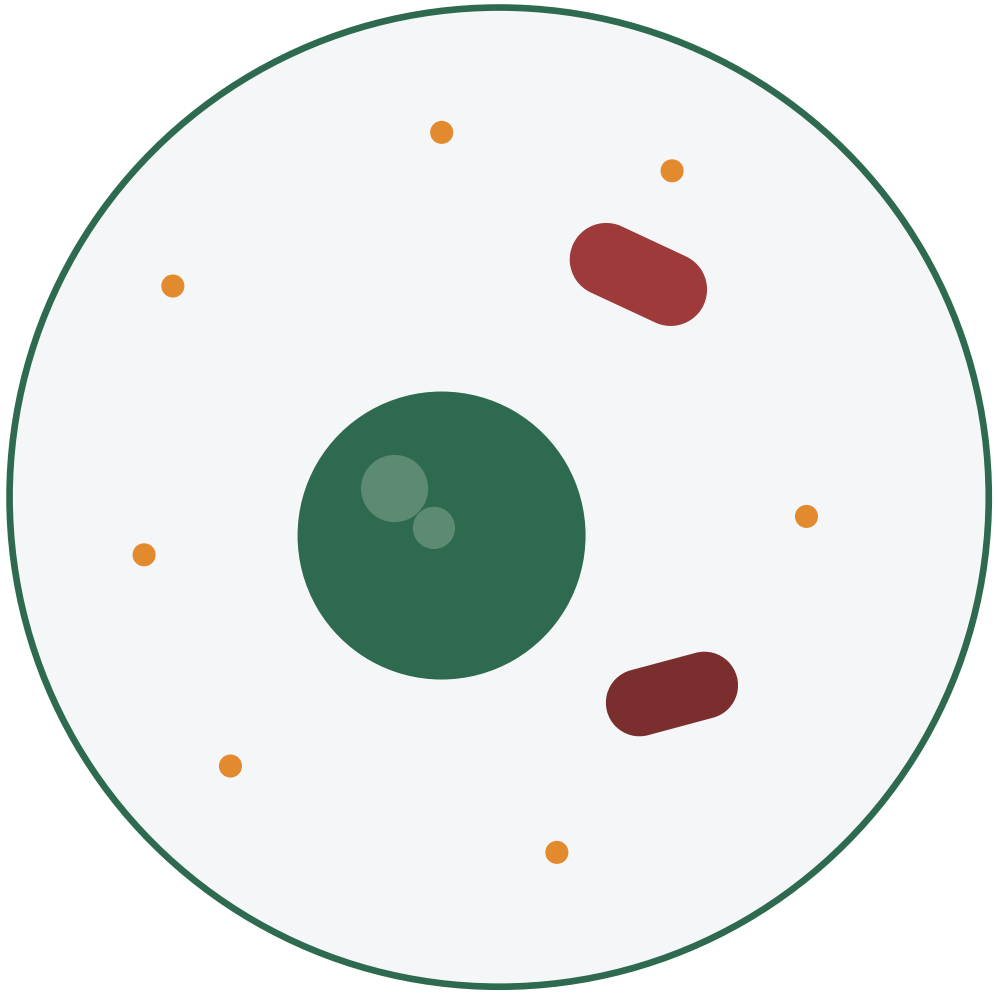
Cell Biology

Teaching Deck 2 of 5 — Microscopy & RP1

Covers Chunks 4–6: Light vs electron microscopy · Magnification maths · RP1: observing cells

AQA 8461 | Edexcel 1BI0 | OCR J247 / J257

Common to all three boards · Combined Science & separate Biology · every student covers this



Where we're going — 5 teaching decks

1 Cell types & structure

Chunks 1–3

1 Eukaryotes & prokaryotes

2 Animal & plant cells

3 Specialisation

THIS DECK

2 Microscopy & RP1

Chunks 4–6

4 Light vs electron microscopy

5 Magnification maths

6 RP1: observing cells

3 Division & stem cells

Chunks 7–8

7 Mitosis & the cell cycle

8 Stem cells

4 Transport

Chunks 9–11

9 Diffusion

10 Osmosis + RP3

11 Active transport

BIO ONLY

5 Microorganisms

Chunks 12–13

12 Culturing microorganisms

13 RP2: antiseptics/antibiotics

Teaching Deck 1 is the foundation — every structure named here gets reused for the rest of the topic.

Which slides do I need?

Each slide is labelled with the board it is for. Find your board, then skip the slides listed — they are not on your specification.

Your board	Slides to SKIP
AQA	None — every slide applies
EDEXCEL	None — every slide applies
OCR	None — every slide applies

Also: Slide 15 (Unit conversion) has an Edexcel side note about pico. Chunk 6 is a required practical on every board. Every slide applies to every board.

Last time — what do you remember?

Answer from memory first. No notes!

1. What is the main difference between where the DNA is in a prokaryotic cell and in an animal cell?

2. Name the three structures plant cells have that animal cells do not.

3. What is cell differentiation?

STARTER

~1 min

“Two microscopes can both magnify an image by the same amount — but one shows a blurry blob and the other shows sharp detail. What's different between them?”

Write your ideas in the box — we'll name the distinction next.

Magnification vs resolution

Magnification

How much bigger the image is than the real object.

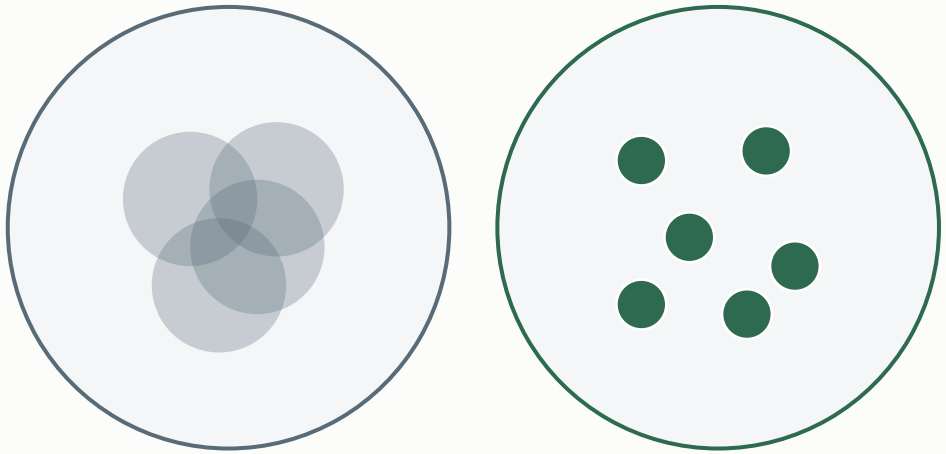
Resolution

The ability to distinguish between two points that are close together — how much fine detail you can actually see, not just how big it looks.

Why electron microscopy matters

Electron microscopes have much higher magnification AND resolving power than light microscopes — this is what's increased our understanding of sub-cellular structures. You don't need to know how one actually works.

Same magnification — different resolution



Low resolution

Blurred together — can't tell how many structures are there.

High resolution

Clearly separated — individual structures visible.

Light microscope vs electron microscope

REQUIRED — examinable on every board

	Light microscope	Electron microscope
Magnification	Lower (up to about ×2000)	Much higher (up to about ×2,000,000)
Resolution	Lower — resolves the nucleus and other large organelles	Much higher — resolves ribosomes and individual organelles
EXTRA CONTEXT	*beyond any single board's spec — useful for texture only, not required for the exam*	
Specimen	Can be living; simple preparation	Must be dead and specially prepared (vacuum)
Image	In colour	Black and white (often false-coloured after)
Cost & size	Cheap, portable, used in schools	Expensive, large, specialist labs only

Preparing a light-microscope slide: typically a thin, often stained specimen — staining highlights structures that would otherwise be hard to see against colourless cytoplasm.

WORKED EXAMPLE

We model the method first — then you try

Two images of the same cell are magnified by the same amount, but one shows far more internal detail than the other. Which was almost certainly taken with an electron microscope, and why?

WORKING

1	**Same magnification, different detail.**	So the difference can't be about how much bigger the image is.
2	**Resolution is what's different.**	Resolution — not magnification — determines how much fine detail is visible.
3	**Electron microscopes have far higher resolution.**	So the more detailed image is the electron microscope one.

Answer: The more detailed image — electron microscopes have much higher resolution than light microscopes, so at the same magnification they reveal more fine structure.

WORKED EXAMPLE

We model the method first — then you try

Compare light microscopes with electron microscopes, and explain why electron microscopes have increased our understanding of sub-cellular structures. (6 marks)

WORKING

1	**Magnification and resolution.**	Magnification: how much bigger the image is than the real object. Resolution: the ability to distinguish two close points — how much fine detail you can see.
2	**Light vs electron.**	Light: lower magnification and resolution; shows the nucleus and other large organelles. Electron: much higher; shows ribosomes and individual organelles.
3	**The link to understanding.**	Higher resolution reveals detail that a light microscope cannot, so sub-cellular structures can be seen and studied.

Answer: Magnification is how much bigger the image is than the real object, and resolution is the ability to distinguish two close points, so it decides how much detail can be seen. Light microscopes have lower magnification and resolution and show the nucleus and other large organelles, whereas electron microscopes have much higher magnification and resolution and show ribosomes and individual organelles. This extra detail is why electron microscopes have increased our understanding of sub-cellular structures.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Define magnification and resolution, and explain the difference between them.

2. Give two differences between light and electron microscopes.

3. Why is a specimen often stained before being viewed under a light microscope?

ANSWERS

Check your own work

1 Magnification is how much bigger the image appears than the real object; resolution is the ability to distinguish two close points as separate, i.e. how much detail is visible.

2 Any two: electron microscopes have much higher magnification/resolution; light microscopes can view living specimens, electron microscopes cannot; light microscope images are in colour, electron microscope images are black and white.

3 To highlight structures that would otherwise be difficult to see against colourless cytoplasm.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **"Higher magnification always means more detail."** Not necessarily — resolution determines detail, not magnification alone.
- ✖ **Thinking electron microscopes just "zoom in more."** The huge jump in resolution is what matters most, not only the magnification.
- ✖ **Forgetting the living-specimen difference.** Light microscopes can view living specimens; electron microscopes cannot.

✅ IN A NUTSHELL

- Magnification: how much bigger. Resolution: how much detail.
- Electron microscopes: much higher magnification AND resolution than light microscopes.
- Light microscope: living specimens, colour image, cheap and portable.
- Electron microscope: dead/vacuum-prepared, black & white, expensive and specialist.

NEXT Chunk 5 — Magnification maths →

STARTER

~1 min

“A cell looks 4 cm wide in a photo, but you know its real width is 0.04 mm. How many times has it been magnified?”

Have a go, including the unit conversion — we'll formalise the method next.

The magnification formula

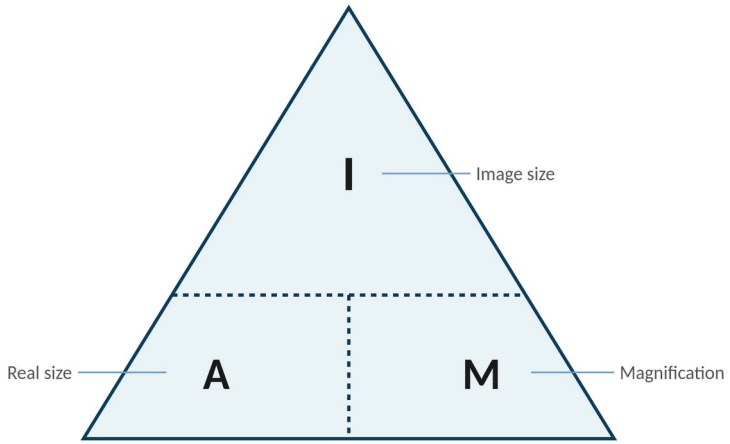
magnification = size of image ÷ size of real object

Always write the unit

A magnification has no unit, but image size and real size do — write mm, µm or nm after every length in your working.

Unit conversion is the real skill

Image size and real size must be in the same unit before you divide — this is where most marks are lost, not in the division itself.



Cover the value you want: the other two show the calculation

Unit conversion — where marks are lost

Practise converting between mm, µm (micrometres, 10^{-6} m) and nm (nanometres, 10^{-9} m) fluently.

Prefix	Value
milli (m)	$\times 10^{-3}$
micro (µ)	$\times 10^{-6}$
nano (n)	$\times 10^{-9}$

EDEXCEL: also names pico (10^{-12}) explicitly in its unit list (spec 1.5) — unlikely to come up often, but worth a mention for a 1BI0 student aiming for the top grades.

Worked conversion

1 mm = **1000 µm** *(× 1000)*

1 µm = **1000 nm** *(× 1000)*

1 mm = **1,000,000 nm** *(× 1,000,000)*

Convert BEFORE you divide — always double-check image size and real size share the same unit.

WORKED EXAMPLE 1

We model the method first — then you try

A cell appears 8 mm wide in an image. Its real width is 20 µm. Calculate the magnification.

WORKING

1	**Convert to the same unit first.**	8 mm = 8000 µm.
2	**Apply the formula.**	Magnification = image size ÷ real size.
3	**Calculate.**	8000 ÷ 20 = ×400.

Answer: ×400.

WORKED EXAMPLE 2

We model the method first — then you try

A real structure is 2.5 µm wide and is magnified × 2000. What is the size of the image, in mm?

WORKING

1	**Rearrange the formula.**	Image size = real size × magnification.
2	**Calculate in µm.**	2.5 × 2000 = 5000 µm.
3	**Convert to mm.**	5000 µm = 5 mm.

Answer: 5 mm.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Give the equation linking magnification, image size and real size.

2. A cell is 0.05 mm wide in real life and appears 15 mm wide in a diagram. Calculate the magnification.

3. An organelle has a real size of 800 nm. It is magnified × 5000. Calculate the image size in mm.

ANSWERS

Check your own work

1. magnification = size of image ÷ size of real object.

2. 15 ÷ 0.05 = ×300.

3. 800 nm = 0.0008 mm; image size = 0.0008 × 5000 = 4 mm.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Dividing before converting units.** Image size and real size must be in the same unit first — the single biggest source of dropped marks.
- ✖ **Mixing up which way the formula goes.** It's image ÷ real, not real ÷ image — check the answer is a sensible magnification (>1), not a tiny fraction.
- ✖ **Forgetting the unit or the final conversion.** If the question asks for the image size in mm, 5000 µm is not finished — convert it to 5 mm and write the unit.

✅ IN A NUTSHELL

- magnification = size of image ÷ size of real object.
- Convert to the same unit before you calculate — always.
- milli $\times 10^{-3}$, micro $\times 10^{-6}$, nano $\times 10^{-9}$ (Edexcel also: pico $\times 10^{-12}$).
- Always write the unit after a length, and check it matches the one the question asks for.

NEXT Chunk 6 — RP1: observing plant and animal cells →

STARTER

~1 min

“You've drawn a beautiful, detailed sketch of an onion cell — but you'll lose marks if you leave off one thing. What is it?”

Write your ideas in the box — we'll confirm it next.

Preparing and viewing a slide

Prepare the slide

A thin specimen (e.g. onion epidermis, or cheek cells on a swab) in a drop of water or stain, then lower a coverslip at an angle using a mounted needle, to avoid trapping air bubbles.

Stains highlight structures

Iodine solution for plant cells, methylene blue for animal cells — both highlight structures otherwise hard to see against colourless cytoplasm.

View and draw

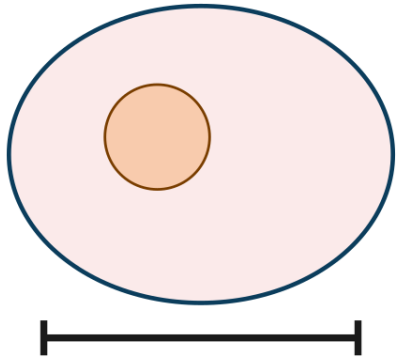
Start with the lowest-power objective lens, focus with coarse then fine focus wheels before moving to higher power. Draw in pencil, with clear uncrossed label lines, no shading, and proportions matching what was actually seen.

Calculating total magnification

Total magnification = eyepiece lens magnification × objective lens magnification. E.g. a ×10 eyepiece with a ×40 objective gives ×400 — a different calculation from the image ÷ real size formula in Chunk 5, and worth knowing separately.

Constructing (and reading) a scale bar

1. Draw the scale bar under your drawing



10 µm

(measured on the page: bar = 40 mm long)

2. Use the bar to find the magnification

Measure the bar's length on the page:

40 mm = 40 000 µm

Read what the bar represents:

10 µm (the real distance)

Divide: magnification = image ÷ real

40 000 ÷ 10 = ×4000

To draw your own scale bar:

1. Pick a round real-life length (e.g. 10 µm, 50 µm).
2. Multiply by your magnification to get the bar's length on the page.
3. Draw a bar that length next to your drawing, and label it with the real length.

On every board: a magnification scale must be included on the drawing — an explicit, examinable requirement, and a very easy mark to drop by forgetting it. Working backwards from a finished drawing is just the Chunk 5 formula: measure the bar's length on the page, divide by the real length it's labelled with.

WORKED EXAMPLE

We model the method first — then you try

Describe how to prepare, view and draw a slide of onion epidermis cells, including how to show the magnification. (6 marks)

WORKING

1. **Prepare.** Place a thin layer of epidermis in a drop of water or stain on a slide; lower a coverslip at an angle using a mounted needle, to avoid trapping air bubbles.
2. **View.** Start with the lowest-power objective lens; focus with the coarse then fine focus wheels before moving to a higher power.
3. **Draw and scale.** Draw in pencil with clear, uncrossed label lines, no shading and true proportions; include a scale bar labelled with the real-life length it represents.

Answer: Place a thin layer of onion epidermis in a drop of water or stain on a slide, and lower a coverslip at an angle with a mounted needle to avoid trapping air bubbles. View it starting with the lowest-power objective lens, focusing with the coarse and then the fine focus wheels before moving to a higher power. Draw what you see in pencil, with clear, uncrossed label lines, no shading and true proportions, and include a scale bar labelled with the real-life length it represents.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Describe how to prepare a slide of onion epidermis cells for viewing under a light microscope.

2. A cell drawing is magnified × 1500. What real-life length should a scale bar represent if you want it to be drawn 15 mm long?

3. A scale bar is measured as 30 mm long on the page and is labelled 15 µm. What is the magnification of the drawing?

ANSWERS

Check your own work

1. Peel a thin layer of epidermis, place it in a drop of water/stain on a slide, then lower a coverslip at an angle to avoid trapping air bubbles.

2. Real length = bar length ÷ magnification = 15 mm ÷ 1500 = 0.01 mm = 10 µm.

3. 30 mm = 30,000 µm; magnification = 30,000 ÷ 15 = ×2000.

Key terms for this deck

Term	Meaning
Magnification	How much bigger the image is than the real object.
Resolution	The ability to distinguish between two points that are close together — how much fine detail you can see.
Light microscope	Lower magnification and resolution; can view living specimens; colour image.
Electron microscope	Much higher magnification and resolution; specimen must be dead; black and white image.
Unit conversion	Changing both lengths to the same unit before dividing — e.g. 5000 µm = 5 mm.
Millimetre (mm)	$\times 10^{-3}$ of a metre.

Term	Meaning
Micrometre (µm)	$\times 10^{-6}$ of a metre; 1 mm = 1000 µm.
Nanometre (nm)	$\times 10^{-9}$ of a metre; 1 µm = 1000 nm.
Stain	Highlights structures that would be hard to see against colourless cytoplasm.
Total magnification	Eyepiece lens magnification × objective lens magnification.
Scale bar	A bar drawn next to a drawing, labelled with the real-life length it represents.
Coverslip	Lowered onto the specimen at an angle to avoid trapping air bubbles.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Forgetting the scale bar or magnification entirely.** The single easiest mark to drop in this whole topic — make it a habit, not an afterthought.
- ✖ **Labelling the bar with the magnification number.** Label it with the real-life length it represents, not the magnification.
- ✖ **Adding shading or detail that wasn't actually seen.** Biological drawings must reflect only what was observed — no shading, true proportions.

✅ IN A NUTSHELL

- Always include a magnification scale — examinable on every board.
- Draw the bar next to the drawing, labelled with the real-life length.
- Pencil, uncrossed label lines, no shading, true proportions.
- Reading a scale bar backwards is just the Chunk 5 formula.

NEXT Teaching Deck 3 — Division & stem cells →

GCSE BIOLOGY · TEACHING DECK

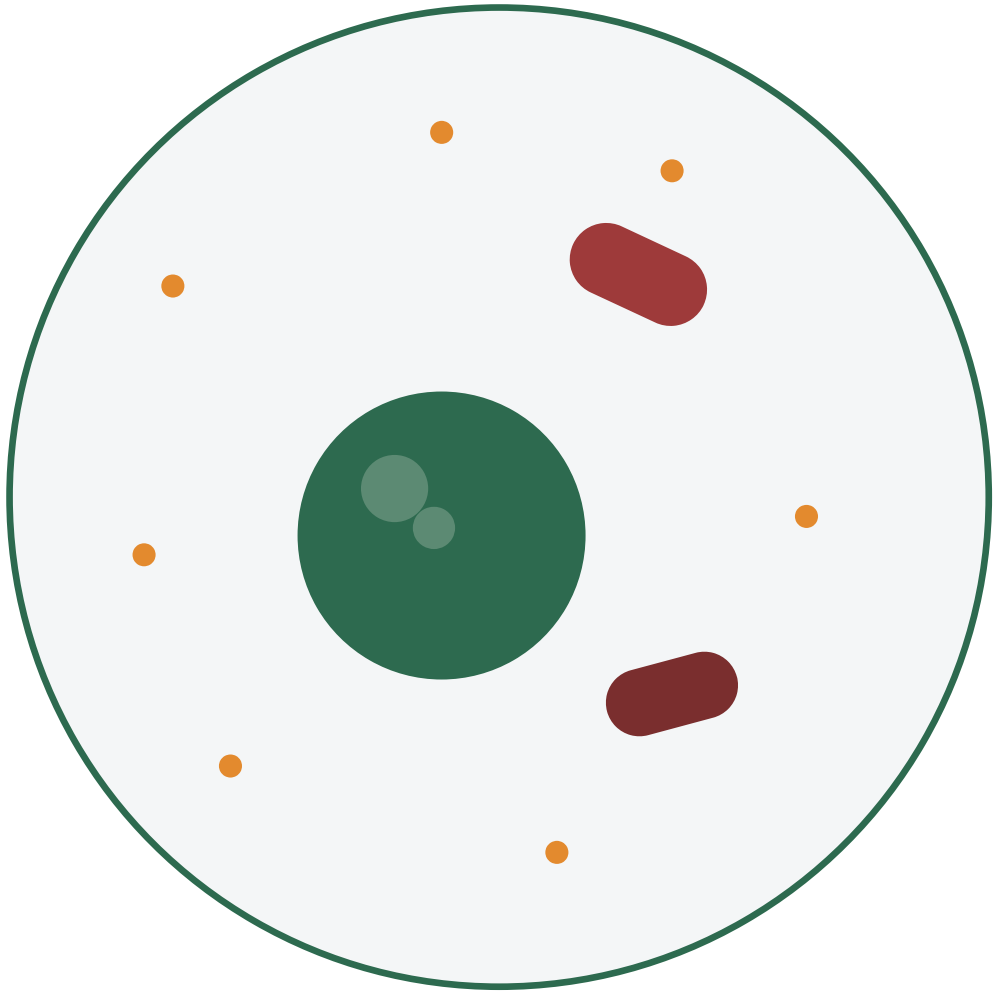
Cell Biology

Teaching Deck 3 of 5 — Division & stem cells

Covers Chunks 7–8: Mitosis & the cell cycle · Stem cells

AQA 8461 | Edexcel 1BI0 | OCR J247 / J257

Common to all three boards · Combined Science & separate Biology · every student covers this



Where we're going — 5 teaching decks

1 Cell types & structure

Chunks 1–3

1 Eukaryotes & prokaryotes

2 Animal & plant cells

3 Specialisation

2 Microscopy & RP1

Chunks 4–6

4 Light vs electron microscopy

5 Magnification maths

6 RP1: observing cells

THIS DECK

3 Division & stem cells

Chunks 7–8

7 Mitosis & the cell cycle

8 Stem cells

4 Transport

Chunks 9–11

9 Diffusion

10 Osmosis + RP3

11 Active transport

BIO ONLY

5 Microorganisms

Chunks 12–13

12 Culturing microorganisms

13 RP2: antiseptics/antibiotics

Teaching Deck 1 is the foundation — every structure named here gets reused for the rest of the topic.

Which slides do I need?

Each slide is labelled with the board it is for. Find your board, then skip the slides listed — they are not on your specification.

Your board	Slides to SKIP
AQA	None — every slide applies
EDEXCEL	None — every slide applies
OCR	None — every slide applies

Also: Slide 7 shows what each board needs for mitosis — find your own panel. Practice question 3 on slide 10 is [Edexcel] only; question 3 on slide 18 is [AQA] only. Every slide applies to every board.

Last time — what do you remember?

Answer from memory first. No notes!

1. What is the difference between magnification and resolution?

2. Write the equation linking magnification, image size and real size.

3. Name one thing a good biological drawing must include or avoid.

STARTER

~1 min

“Every cell in your body (almost) contains an identical copy of your DNA. How does a single cell make an exact copy of itself, chromosomes and all?”

Write your ideas in the box — we'll build the vocabulary next.

Chromosomes and the cell cycle

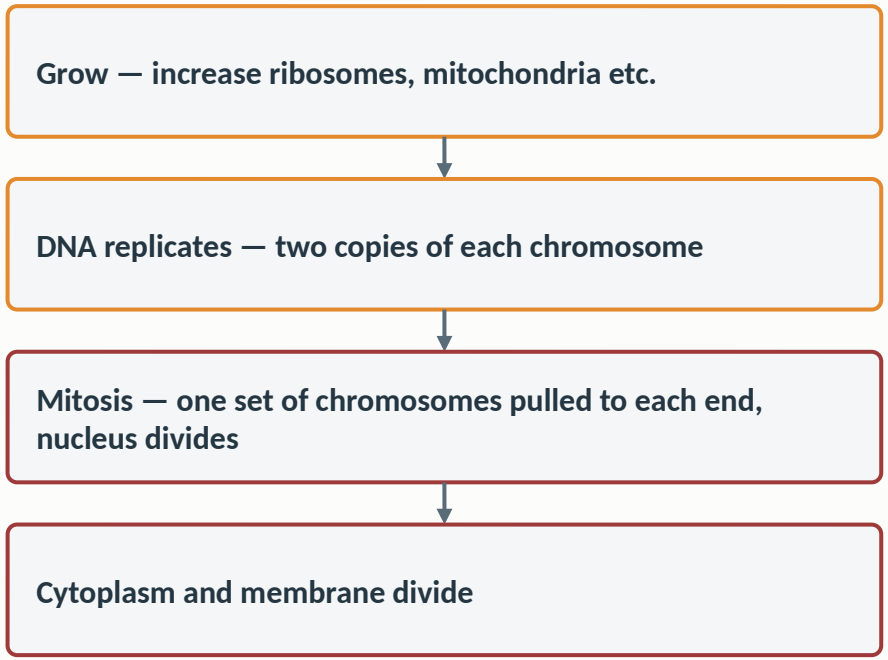
Common to all three boards.

Chromosomes

The nucleus contains chromosomes made of DNA molecules. Each chromosome carries a large number of genes. In body cells, chromosomes are normally found in pairs (46 chromosomes, 23 pairs, in humans).

Mitosis matters for

Growth and development of multicellular organisms, and repair. Recognise it in context: growth, asexual reproduction, replacing damaged tissue.



How much mitosis detail is required?

AQA & OCR — keep it broad

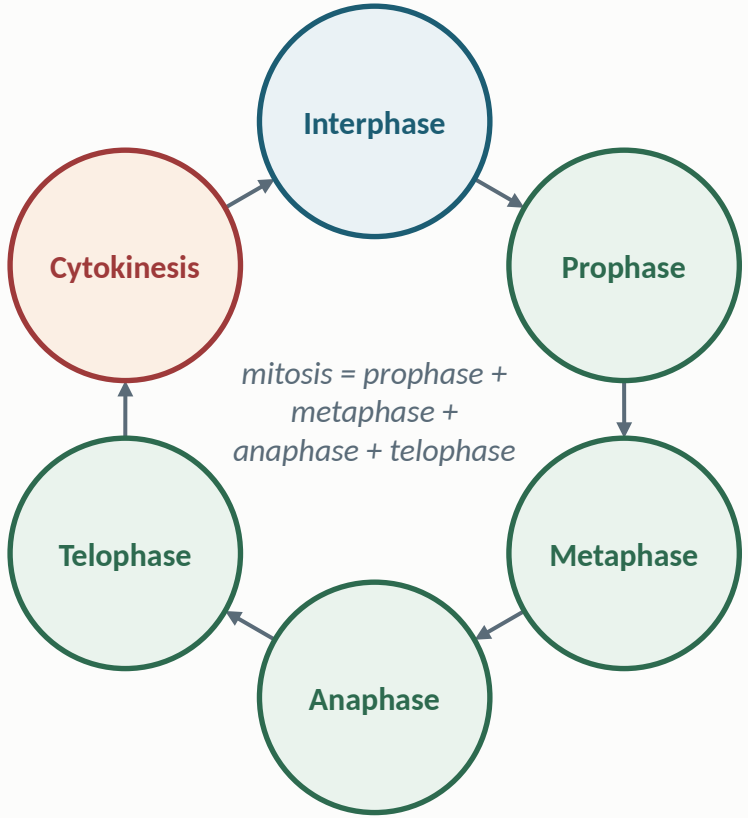
1. Growth & DNA replication
2. Division of the nucleus
3. Division of the cytoplasm & membranes

Named phases NOT required: prophase, metaphase, anaphase, telophase are explicitly outside both AQA and OCR's specs.

OCR wording differs slightly by spec (Gateway: growth → replication → growth → chromosome movement. 21st Century: interphase + mitosis) — but neither needs the named phases.

EDEXCEL — full named stages required

The cell cycle (Edexcel level of detail)



- **Interphase**
  The cell grows and DNA replicates.
- **Prophase**
  Chromosomes condense and become visible.
- **Metaphase**
  Chromosomes line up at the equator.
- **Anaphase**
  Chromatids are pulled to opposite poles.
- **Telophase**
  Nuclear envelopes reform around each set.
- **Cytokinesis**
  The cytoplasm divides into two identical cells.

WORKED EXAMPLE

We model the method first — then you try

A doctor takes a skin biopsy to repair a wound. Which type of cell division is responsible for replacing the damaged skin cells, and why?

WORKING

1	**Identify what's needed.**	New cells that exactly match the surrounding healthy tissue.
2	**Identify the division type.**	Mitosis produces two genetically identical daughter cells.
3	**Connect it to the context.**	That's exactly what's needed to replace damaged tissue with matching new cells.

Answer: Mitosis — it produces two genetically identical daughter cells, which is exactly what's needed to replace damaged tissue with matching new cells.

WORKED EXAMPLE

We model the method first — then you try

Describe what happens to a cell during the cell cycle, and explain why mitosis is important in a multicellular organism. (6 marks)

WORKING

1	**Growth and DNA replication.**	The cell grows (increasing ribosomes, mitochondria etc.) and its DNA replicates, giving two copies of each chromosome.
2	**Division.**	In mitosis one set of chromosomes is pulled to each end and the nucleus divides; then the cytoplasm and cell membrane divide, making two genetically identical daughter cells.
3	**Why it matters.**	Mitosis is needed for growth and development of multicellular organisms, and for repair — replacing damaged tissue with matching cells.

Answer: In the cell cycle the cell first grows and its DNA replicates, so there are two copies of each chromosome. In mitosis one set of chromosomes is pulled to each end of the cell and the nucleus divides, and then the cytoplasm and cell membrane divide, producing two genetically identical daughter cells. Mitosis is important in multicellular organisms for growth and development, and for repairing damaged tissue by replacing it with matching new cells.

YOUR TURN

Have a go before we check — answers on the next slide.

1. What is a chromosome made of, and where is it found?

2. Describe the three overall stages of the cell cycle.

3. [Edexcel only] Name the stages of mitosis in order, and state one thing that happens in metaphase.

4. Give one example of a situation where mitosis is occurring in the human body.

ANSWERS

Check your own work

1. DNA, found in the nucleus of a cell.

2. Growth and DNA replication (the cell grows and copies its chromosomes); division of the nucleus (one set of chromosomes pulled to each end); division of the cytoplasm and membranes (forming two identical cells).

3. Interphase, prophase, metaphase, anaphase, telophase, cytokinesis; in metaphase, chromosomes line up at the equator of the cell and attach to spindle fibres.

4. Any valid example: growth of a child, repair of a wound/damaged tissue, replacement of skin or blood cells.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Learning the named phases when your board doesn't need them.** Interphase/prophase/metaphase/anaphase/telophase is Edexcel-only — AQA and both OCR specs need just the three broad stages.
- ✖ **Saying mitosis produces different cells.** The two daughter cells are genetically identical to the parent cell — that's the whole point.
- ✖ **Forgetting the growth/replication step.** Chromosomes must be copied before division — mitosis doesn't start from nothing.

✅ IN A NUTSHELL

- Chromosomes (DNA) sit in the nucleus, normally in pairs in body cells.
- Cell cycle: grow & replicate DNA → nucleus divides → cytoplasm divides.
- Mitosis makes two genetically identical daughter cells — growth, repair, replacement.
- AQA/OCR: three broad stages only. Edexcel: full named stages required.

NEXT Chunk 8 — Stem cells →

STARTER

~1 min

“Some cells never really 'finish' becoming one particular type — they stay flexible their whole life. What are they, and why is medicine so interested in them?”

Write your ideas in the box — we'll name and place them next.

What stem cells can do

A stem cell: an undifferentiated cell capable of giving rise to many more cells of the same type, from which other cell types can then arise through differentiation.

Source	What it can do
Human embryos	Can be cloned and made to differentiate into most different types of human cell.
Adult bone marrow	Can form many types of cell, including different types of blood cell (more limited than embryonic stem cells).
Meristem tissue in plants	Can differentiate into any type of plant cell, throughout the life of the plant.

Medical uses, ethics, and plant cloning

MEDICAL USES — HUMAN/ANIMAL STEM CELLS

- Treats conditions like diabetes and paralysis.
- Risk: possible transfer of viral infection.
- Ethical/religious objections — especially using human embryos.

Skill: *give a balanced, two-sided evaluation — risks/benefits AND ethical issues, not just a list of benefits.*

AQA: therapeutic cloning — an embryo made with the patient's own genes, so its stem cells aren't rejected by the patient's immune system.

OCR: asks students to clearly distinguish what embryonic vs adult stem cells each can and can't become.

PLANT STEM CELLS — MERISTEMS

Can be used to clone plants

Quickly and economically — meristem tissue keeps the ability to differentiate into any plant cell type throughout the plant's life.

Protecting rare species

Cloning can rapidly produce more individuals of a rare or endangered plant species.

Reliable crop production

Mass-produces large numbers of identical plants with a useful feature, e.g. disease resistance.

EDEXCEL / OCR: AQA's spec names these two uses (rare species, disease-resistant crops). Edexcel covers tissue culture for plant breeding (4.9B, Biology-only); OCR names meristems only. Kept here as useful extra detail.

WORKED EXAMPLE

We model the method first — then you try

Explain one advantage and one risk of using embryonic stem cells to treat a patient with a spinal injury.

WORKING

1. **Give the advantage.**

   Embryonic stem cells can differentiate into most human cell types — could grow new nerve tissue to repair the damage.

2. **Give the risk.**

   Risk of transferring viral infection.

3. **Give the ethical dimension too.**

   Some people raise ethical objections to using stem cells from human embryos — a balanced answer covers both sides.

Answer: Advantage — embryonic stem cells can differentiate into most human cell types, so could be used to grow new nerve tissue. Risk — possible viral infection transfer, and some people raise ethical objections to using cells from human embryos.

WORKED EXAMPLE

We model the method first — then you try

Evaluate the use of stem cells in medicine. (6 marks)

WORKING

1	**What they are.**	Undifferentiated cells that can divide to give more of their own type, and then differentiate into other cell types. Embryonic stem cells can become most human cell types; adult stem cells (e.g. bone marrow) are more limited.
2	**Benefits.**	They can treat conditions such as diabetes and paralysis — for example, growing new nerve tissue to repair damage.
3	**Risks and ethics.**	Possible transfer of viral infection; ethical or religious objections, especially to using human embryos. A balanced answer weighs both sides.

Answer: Stem cells are undifferentiated cells that can divide to make more of their own type and then differentiate into other cell types; embryonic stem cells can become most human cell types, while adult stem cells such as those in bone marrow are more limited. They could be used to treat conditions such as diabetes and paralysis, for example by growing new nerve tissue. However, there is a risk of transferring viral infection, and some people have ethical or religious objections, especially to using human embryos, so the benefits have to be weighed against these.

YOUR TURN

Have a go before we check — answers on the next slide.

1. What is a stem cell?

2. Compare what embryonic and adult stem cells are each capable of.

3. [AQA] Give one advantage of therapeutic cloning for producing stem cells for a patient.

4. Give one risk and one ethical concern associated with the use of stem cells in medicine.

5. Give two reasons why cloning plants from meristem cells is useful.

ANSWERS

Check your own work

1. An undifferentiated cell capable of dividing to produce more cells of the same type, some of which can then differentiate into other cell types.

2. Embryonic stem cells can differentiate into most/all human cell types; adult stem cells (e.g. from bone marrow) can only form a more limited range, such as different blood cells.

3. The embryo shares the patient's genes, so stem cells from it are not rejected by the patient's immune system.

4. Risk: transfer of viral infection. Ethical concern: objections to the use of human embryos (religious or otherwise).

5. Any two: rapid, economical production of identical plants; can protect rare/endangered species from extinction; can mass-produce crop plants with useful features such as disease resistance.

Key terms for this deck

Term	Meaning
Chromosome	Made of DNA molecules, found in the nucleus; each carries a large number of genes.
Cell cycle	Growth and DNA replication, then division of the nucleus, then division of the cytoplasm and membranes.
Mitosis	Division of the nucleus — one set of chromosomes is pulled to each end.
Genetically identical	Mitosis makes two daughter cells that are genetically identical to the parent cell.
Interphase (Edexcel)	The cell grows and DNA replicates.
Cytokinesis (Edexcel)	The cytoplasm divides into two identical cells.

Term	Meaning
Stem cell	An undifferentiated cell that can give rise to more cells of the same type, and to other cell types by differentiation.
Embryonic stem cell	Can be made to differentiate into most types of human cell.
Adult stem cell	Can form many types of cell, such as blood cells, but is more limited than embryonic.
Meristem tissue	Plant stem cells at the growing tips; can differentiate into any plant cell type throughout life.
Therapeutic cloning (AQA)	An embryo made with the patient's own genes, so its stem cells are not rejected.
Cloning plants	Meristem tissue lets plants be cloned quickly and economically.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Giving only benefits, no risks or ethics.** Examiners want a balanced, two-sided evaluation — a one-sided answer loses marks even if every point is correct.
- ✖ **Mixing up embryonic and adult stem cell abilities.** Embryonic: most/all human cell types. Adult: a more limited range, e.g. blood cells only.
- ✖ **Forgetting plant stem cells (meristems) exist.** They're just as examinable as human stem cells, and their uses are commercial, not medical.

✅ IN A NUTSHELL

- Stem cell: undifferentiated, can produce more of itself and other types.
- Embryonic (most flexible) vs adult (more limited) vs plant meristem (flexible for life).
- Medical uses come with real risks and ethical objections — evaluate both sides.
- AQA: therapeutic cloning. OCR: embryonic vs adult distinction. Plants: rare-species and crop cloning.

NEXT Teaching Deck 4 — Transport →

GCSE BIOLOGY · TEACHING DECK

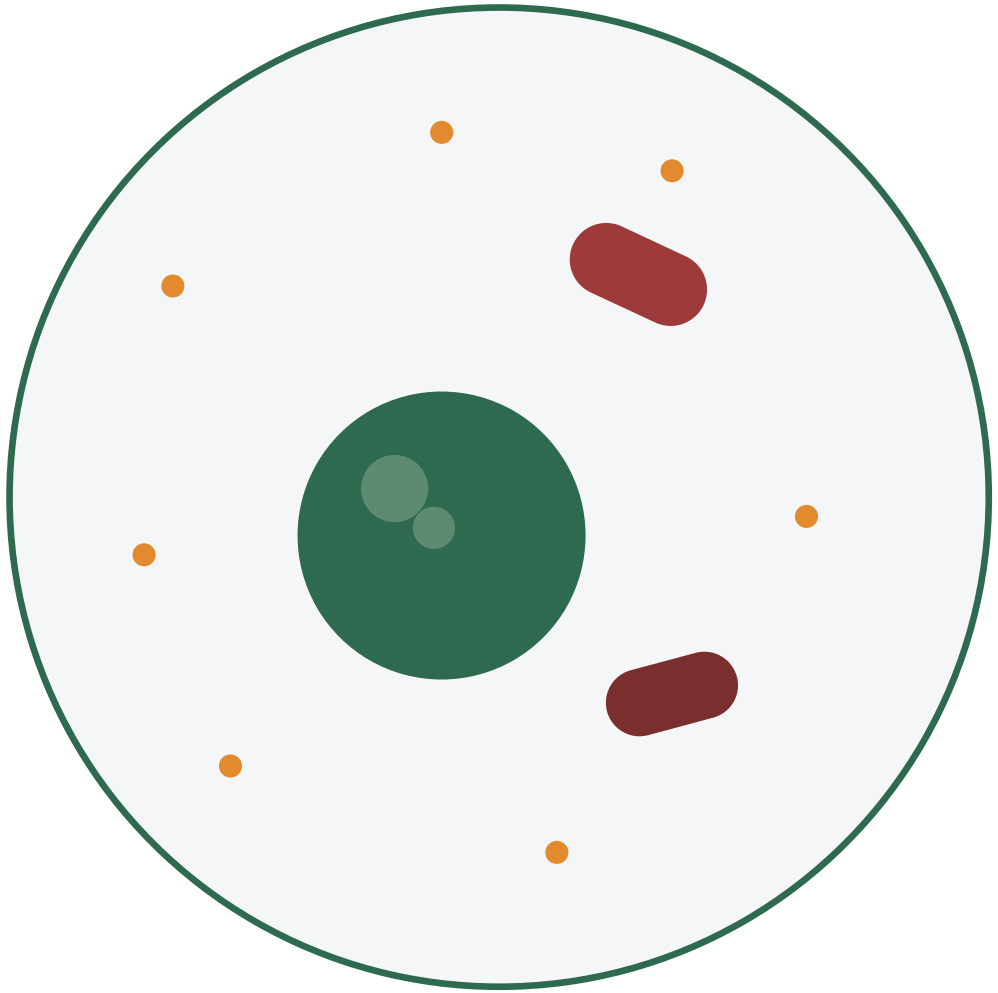
Cell Biology

Teaching Deck 4 of 5 — Transport

Covers Chunks 9–11: Diffusion · Osmosis + RP3 · Active transport

AQA 8461 | Edexcel 1BI0 | OCR J247 / J257

Common to all three boards · Combined Science & separate Biology · one Edexcel Biology-only slide (Fick's law) is flagged



Where we're going — 5 teaching decks

1 Cell types & structure

Chunks 1–3

1 Eukaryotes & prokaryotes

2 Animal & plant cells

3 Specialisation

2 Microscopy & RP1

Chunks 4–6

4 Light vs electron microscopy

5 Magnification maths

6 RP1: observing cells

3 Division & stem cells

Chunks 7–8

7 Mitosis & the cell cycle

8 Stem cells

THIS DECK

4 Transport

Chunks 9–11

9 Diffusion

10 Osmosis + RP3

11 Active transport

BIO ONLY

5 Microorganisms

Chunks 12–13

12 Culturing microorganisms

13 RP2: antiseptics/antibiotics

Teaching Deck 1 is the foundation — every structure named here gets reused for the rest of the topic.

Which slides do I need?

Each slide is labelled with the board it is for. Find your board, then skip the slides listed — they are not on your specification.

Your board	Slides to SKIP
AQA	8
EDEXCEL	None — every slide applies (Edexcel Combined Science: also skip 8)
OCR	8

Also: Slide 8 (Fick's law) is Edexcel 1BI0 separate Biology only — Edexcel Combined Science students skip it too. Slide 15 (Osmosis) has an OCR side note: Gateway and 21st Century treat “water potential” differently. Every other slide applies to every board.

Last time — what do you remember?

Answer from memory first. No notes!

1. What is a stem cell?

2. What does mitosis produce, and when does it happen in the human body?

3. Name the three overall stages of the cell cycle.

STARTER

~1 min

“Spray a tiny bit of perfume in the corner of a room, and eventually you can smell it everywhere — with no fan, no stirring. What's actually happening?”

Write your ideas in the box — we'll name the process next.

What is diffusion?

Diffusion

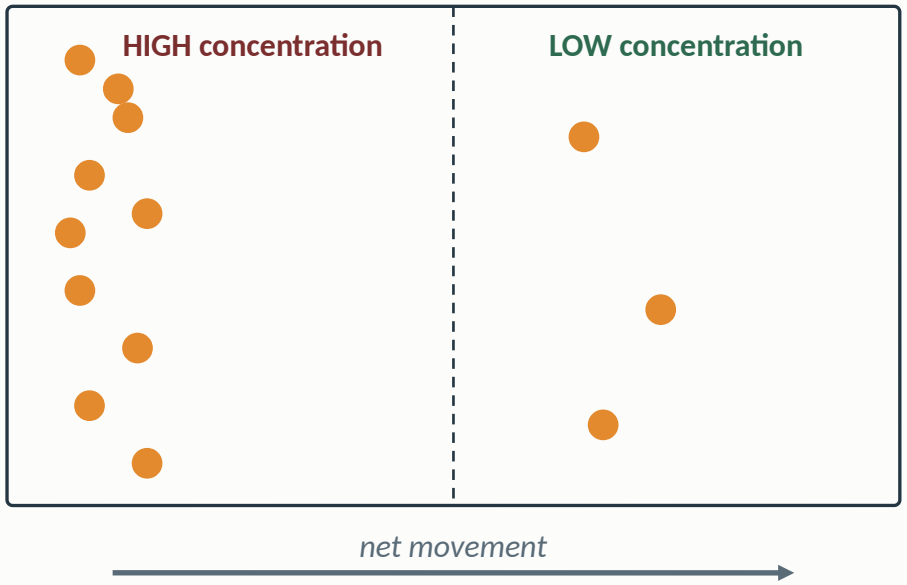
The spreading out of particles of any substance in solution, or particles of a gas — net movement from an area of higher concentration to an area of lower concentration, down a concentration gradient.

Examples

Oxygen and carbon dioxide during gas exchange; the waste product urea moving from cells into the blood plasma for excretion by the kidney.

Three factors affect the rate

The concentration gradient, the temperature, and the surface area of the membrane.



Down the concentration gradient — no energy needed.

Effective exchange surfaces

As organisms get bigger,

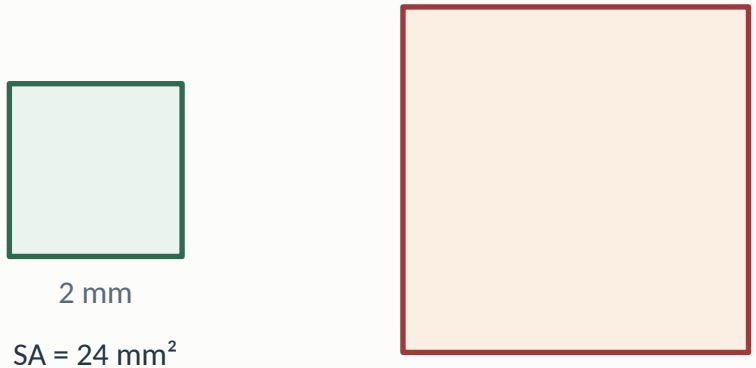
surface area to volume ratio falls — diffusion across the outer surface alone can no longer supply/remove enough for every cell, so multicellular organisms need specialised exchange surfaces and transport systems.

An effective exchange surface has:

A large surface area; being thin (short diffusion path); (animals) an efficient blood supply; (animals, gas exchange) being ventilated.

Apply, don't just recite: you need to apply these four principles to named examples — lungs, small intestine, fish gills, root hair cells — not just list them in the abstract.

Surface area : volume falls as size grows



2 mm

SA = 24 mm²
V = 8 mm³

Ratio 3:1

4 mm

SA = 96 mm²
V = 64 mm³

Ratio 1.5:1

Formula: for a cube of side L — surface area = 6 × L^2, volume = L^3, ratio = surface area : volume.

Fick's law

rate of diffusion ∝ (surface area × concentration difference) ÷ thickness of membrane

This is a proportionality (∝), not an exact equals-sign equation — the same three-factor idea as Teach 1 and 2, written as one relationship.

Surface area ↑	**Rate of diffusion ↑**
Concentration difference ↑	**Rate of diffusion ↑**
Membrane thickness ↑	**Rate of diffusion ↓**

EDEXCEL (spec 8.4B–8.5B, Biology only): the “B” marks this as separate Biology content — not in Edexcel Combined Science at all. Neither AQA nor OCR require it as a formal equation either way.

WORKED EXAMPLE

We model the method first — then you try

Fish gills are made of many thin, folded filaments, richly supplied with blood vessels. Explain how this structure adapts gills for efficient gas exchange.

WORKING

1	**Many folded filaments.**	Give gills a very large surface area for gas exchange.
2	**Each filament is thin.**	A short diffusion path for oxygen and carbon dioxide.
3	**Rich blood supply.**	Constantly carries away oxygen and brings fresh CO_2, maintaining a steep concentration gradient.

Answer: Large surface area (folded filaments) + short diffusion path (thin) + rich blood supply (maintains a steep gradient) — the same three principles that apply to the lungs and small intestine.

WORKED EXAMPLE

We model the method first — then you try

Explain why multicellular organisms need specialised exchange surfaces, and describe the features of an effective exchange surface. (6 marks)

WORKING

1	**Why they are needed.**	As organisms get bigger, surface area to volume ratio falls — diffusion across the outer surface alone can no longer supply or remove enough for every cell.
2	**All exchange surfaces.**	A large surface area, and being thin so the diffusion path is short.
3	**In animals.**	An efficient blood supply (keeps the concentration gradient steep) and, for gas exchange, being ventilated.

Answer: As an organism gets bigger its surface area to volume ratio falls, so diffusion across the outer surface alone cannot supply or remove enough for every cell; specialised exchange surfaces and transport systems are needed. An effective exchange surface has a large surface area and is thin, giving a short diffusion path. In animals it also has an efficient blood supply, which maintains a steep concentration gradient, and, for gas exchange, it is ventilated.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Define diffusion.

2. State the three factors that affect the rate of diffusion.

3. Give three features that make a surface effective for exchanging materials.

4. A cube-shaped cell has sides of length 3 mm. Calculate its surface area to volume ratio, giving your answer in its simplest form.

ANSWERS

Check your own work

1 The net movement of particles (in solution or gas) from an area of higher concentration to an area of lower concentration, down a concentration gradient.

2 Concentration gradient, temperature, surface area of the membrane.

3 Any three: large surface area; thin (short diffusion path); efficient blood supply (animals); ventilation (animals, for gas exchange).

4 Surface area = $6 \times 3^2 = 54$ mm^2. Volume = $3^3 = 27$ mm^3. Ratio = 54:27, which simplifies to 2:1.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

✖ **Only naming concentration gradient as a factor.** Temperature and surface area matter too — all three are individually examinable.

✖ **Confusing "bigger surface area" with "better ratio."** A bigger organism has a bigger surface area, but its surface area TO VOLUME ratio still falls.

✖ **Getting Fick's law backwards.** A thicker membrane means a SLOWER rate — thickness is inversely related to rate, not directly.

✅ IN A NUTSHELL

- Diffusion: net movement high → low concentration, no energy needed.
- Rate depends on: concentration gradient, temperature, surface area.
- Effective exchange surfaces: large SA, thin, (animals) good blood supply, ventilated.
- SA:V ratio falls as organisms get bigger — hence the need for exchange surfaces.

NEXT Chunk 10 — Osmosis + RP3 →

💡 STARTER

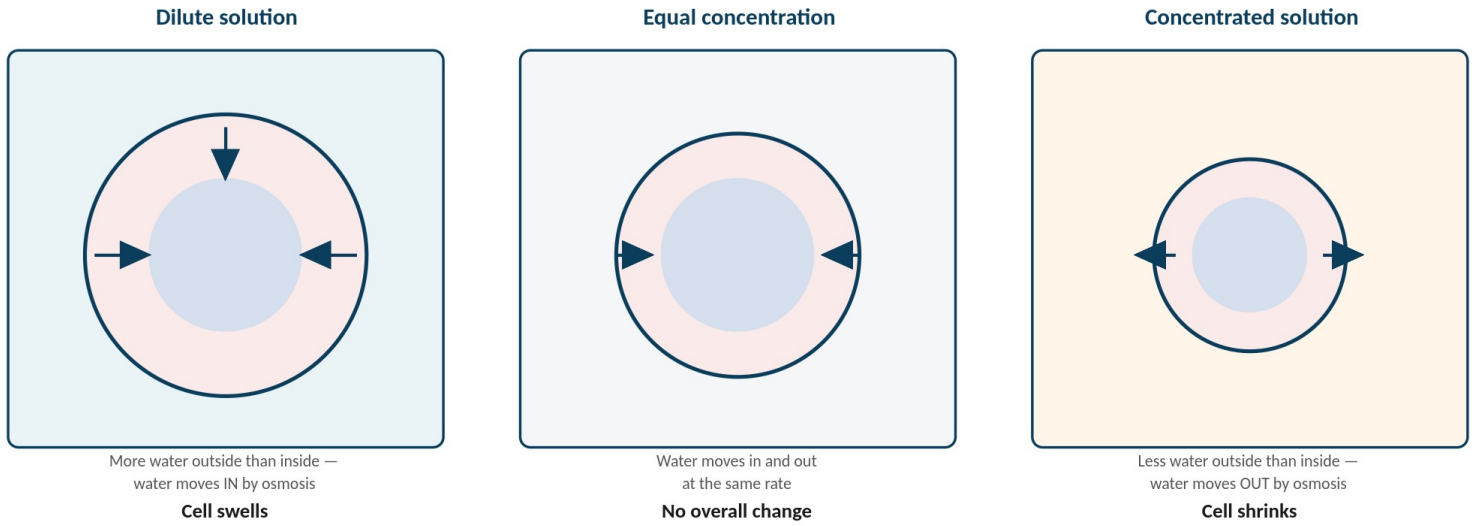
~1 min

“Leave a stick of celery in salty water overnight and it goes limp. Leave a raisin in plain water and it swells up. Same process both times — what is it?”

Write your ideas in the box — we'll define it precisely next.

Osmosis

Osmosis: the diffusion of water from a dilute solution to a concentrated solution, through a partially permeable membrane.



OCR: Gateway (J247) uses “water potential” explicitly (water moves high → low water potential, no maths required). 21st Century (J257) explicitly does NOT require this term — check which spec.

Required practical — salt/sugar solutions and plant tissue

Cut equal-sized cylinders of plant tissue (e.g. potato); measure and record starting mass; place each in a different concentration of salt/sugar solution for a fixed time; blot dry and re-weigh; calculate % change in mass for each; plot % change against concentration.

% change in mass = (final − initial) ÷ initial × 100

Sugar concentration (M)	% change in mass
0.0	+8%
0.2	+4%
0.4	0%
0.6	−4%
0.8	−8%

Zero crossing → concentration inside the tissue ≈ 0.4 M.

Exam skill: given a table/graph, find where the line crosses zero — that concentration matches the solution inside the tissue.

Reading the table

Below 0.4 M: solution more dilute than inside the tissue → water moves IN → mass gain.

Above 0.4 M: solution more concentrated than inside → water moves OUT → mass loss.

WORKED EXAMPLE 1

We model the method first — then you try

Using the table from Teach 2, estimate the concentration of the solution inside the potato cells, and explain your reasoning.

WORKING

1	**Find where % change = 0.**	That's at 0.4 M — no net water movement occurred.
2	**Interpret that point.**	The solution outside must match the concentration inside the cell.
3	**Check the trend either side.**	Below 0.4 M the potato gains mass; above 0.4 M it loses mass — consistent with 0.4 M being the crossover.

Answer: Around 0.4 M — the solution outside must match the concentration inside the cell at this point, since there's no net water movement.

WORKED EXAMPLE 2

We model the method first — then you try

A potato cylinder has an initial mass of 5.0 g. After 30 minutes in a sugar solution, its mass is 4.6 g. Calculate the percentage change in mass, and explain the result in terms of osmosis.

WORKING

1	**Apply the formula.**	% change = (4.6 − 5.0) ÷ 5.0 × 100.
2	**Calculate.**	−0.4 ÷ 5.0 × 100 = −8%.
3	**Explain in terms of osmosis.**	The sugar solution was more concentrated than inside the potato cells, so water moved OUT by osmosis.

Answer: −8% — the sugar solution was more concentrated than the potato cells, so water left the cells by osmosis, causing a mass loss.

WORKED EXAMPLE

We model the method first — then you try

Describe how you would investigate the effect of sugar concentration on the mass of potato tissue, and how you would use the results. (6 marks)

WORKING

1	**Set up.**	Cut equal-sized cylinders of potato; measure and record each starting mass; place each in a different concentration of sugar solution for a fixed time.
2	**Measure.**	Blot dry, re-weigh, and calculate % change in mass = (final − initial) ÷ initial × 100 for each.
3	**Use the results.**	Plot % change against concentration. Where the line crosses zero, the solution matches the concentration inside the potato cells.

Answer: Cut equal-sized cylinders of potato, measure and record the starting mass of each, and place each in a different concentration of sugar solution for a fixed time. Blot each one dry, re-weigh it, and calculate the percentage change in mass as (final − initial) ÷ initial × 100. Plot percentage change against concentration; the concentration where the line crosses zero is where there is no net movement of water, so it matches the concentration inside the potato cells.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Define osmosis.

2. Describe the method for investigating the effect of sugar solution concentration on the mass of potato tissue.

3. A potato cylinder starts at 4.2 g and finishes at 4.62 g after being left in distilled water. Calculate the percentage change in mass, and explain the result in terms of osmosis.

4. A different vegetable's results show 0% change in mass at a sugar concentration of 0.6 M. What does this tell you about the concentration of the solution inside its cells?

ANSWERS

Check your own work

1 The diffusion of water from a dilute solution to a concentrated solution, through a partially permeable membrane.

2 Cut equal-sized potato pieces, weigh each, place in different sugar/salt concentrations for a set time, blot dry, re-weigh, calculate % change in mass for each concentration.

3 % change = (4.62 − 4.2) ÷ 4.2 × 100 = +10%. The distilled water was more dilute than inside the potato cells, so water moved IN by osmosis, causing a mass gain.

4 The solution inside its cells must also be approximately 0.6 M — no net water movement means the concentrations inside and outside match.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Describing osmosis without mentioning water or the membrane.** Osmosis is specifically water, specifically across a partially permeable membrane — both details must appear.
- ✖ **Forgetting to blot dry before re-weighing.** An easy method-mark to drop in the required practical.
- ✖ **Getting the % change sign backwards.** Mass loss is negative, mass gain is positive — check the sign matches the direction described.

✅ IN A NUTSHELL

- Osmosis: water, dilute → concentrated, across a partially permeable membrane.
- % change in mass = (final − initial) ÷ initial × 100.
- Zero-crossing point on a graph/table = concentration matching inside the tissue.
- OCR: check Gateway vs 21st Century before using “water potential.”

NEXT Chunk 11 — Active transport →

STARTER

~1 min

“Root hair cells absorb mineral ions from soil where those ions are more dilute than inside the cell — the opposite direction diffusion would take them. How is that possible?”

Write your ideas in the box — we'll name the process next.

Active transport

Active transport

Moves substances from a more dilute solution to a more concentrated solution — against a concentration gradient. Unlike diffusion and osmosis, this requires energy, supplied by respiration.

In plants

Absorbs mineral ions into root hair cells from very dilute soil solutions, even though ion concentration is already higher inside the cell.

In animals

Absorbs sugar molecules from a lower concentration in the gut into the blood (higher concentration), for use in respiration.

Three transport processes

Diffusion

High → low concentration

Energy? No (passive)

Osmosis

Dilute → concentrated (water only, partially permeable membrane)

Energy? No (passive)

Active transport

Low → high concentration (against the gradient)

Energy? Yes — from respiration

WORKED EXAMPLE

We model the method first — then you try

A root hair cell absorbs nitrate ions from soil where they are more dilute than inside the cell. Name the process involved, and explain why it cannot be diffusion.

WORKING

1	**Check the direction of movement.**	Low concentration (soil) → high concentration (cell).
2	**Rule out diffusion.**	Diffusion only moves substances DOWN a gradient — this is the opposite direction.
3	**Name the correct process.**	Only active transport can move substances against a gradient, using energy from respiration.

Answer: Active transport. It cannot be diffusion because the ions move from a lower to a higher concentration — against the gradient — which only active transport can do, using energy from respiration.

WORKED EXAMPLE

We model the method first — then you try

Compare diffusion, osmosis and active transport. (6 marks)

WORKING

1	**Direction.**	Diffusion: high → low concentration. Osmosis: water from a dilute to a concentrated solution through a partially permeable membrane. Active transport: low → high, against the gradient.
2	**Energy.**	Diffusion and osmosis are passive — they need no energy. Active transport needs energy, supplied by respiration.
3	**Examples.**	Diffusion: oxygen and carbon dioxide in gas exchange. Active transport: mineral ions into root hair cells; sugar from the gut into the blood.

Answer: In diffusion, particles move from a higher to a lower concentration, down the concentration gradient, and osmosis is the diffusion of water from a dilute to a more concentrated solution through a partially permeable membrane; neither needs energy. Active transport moves substances from a lower to a higher concentration, against the gradient, and needs energy supplied by respiration. Examples are oxygen and carbon dioxide in gas exchange by diffusion, and mineral ions into root hair cells or sugar from the gut into the blood by active transport.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Define active transport.

2. Where does the energy for active transport come from?

3. Give one example of active transport in a plant, and one in an animal.

4. Complete: diffusion and osmosis move substances '____' a concentration gradient and need '____' energy; active transport moves substances '____' a concentration gradient and needs '____' energy.

ANSWERS

Check your own work

1. The movement of substances from a more dilute to a more concentrated solution, against a concentration gradient, using energy.

2. Respiration.

3. Plant: absorption of mineral ions into root hair cells from dilute soil solutions. Animal: absorption of sugar molecules from the gut into the blood.

4. Down / no; against / energy.

Key terms for this deck

Term	Meaning
Diffusion	Net movement of particles from a higher to a lower concentration, down a concentration gradient.
Concentration gradient	Diffusion moves particles down it, from higher to lower concentration — no energy needed.
Surface area : volume ratio	Falls as organisms get bigger — which is why they need exchange surfaces.
Exchange surface	Large surface area, thin, (animals) efficient blood supply, (gas exchange) ventilated.
Fick's law (Edexcel Biology)	Rate of diffusion ∝ (surface area × concentration difference) ÷ membrane thickness.
Osmosis	The diffusion of water from a dilute to a concentrated solution through a partially permeable membrane.

Term	Meaning
% change in mass	(final − initial) ÷ initial × 100.
Zero crossing	Where % change is 0 — the solution matches the concentration inside the tissue.
Active transport	Moves substances from dilute to concentrated, against the gradient; needs energy from respiration.
Respiration	The process that supplies the energy for active transport.
Passive	Needs no energy — diffusion and osmosis.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

✖ **Forgetting active transport needs energy.** It's the one process of the three that does — always name respiration as the source.

✖ **Mixing up the direction.** Active transport goes AGAINST the gradient (low → high) — the opposite of diffusion and osmosis.

✖ **Only giving one named example.** Know both: mineral ions in plants, sugar absorption in animals — examiners may ask for either.

✅ IN A NUTSHELL

- Active transport: low → high concentration, against the gradient.
- Needs energy from respiration — the only one of the three that does.
- Plants: mineral ions into root hairs. Animals: sugar from gut into blood.
- Diffusion, osmosis and active transport: know the direction and energy cost of each.

NEXT Teaching Deck 5 — Microorganisms →

GCSE BIOLOGY · TEACHING DECK

Cell Biology

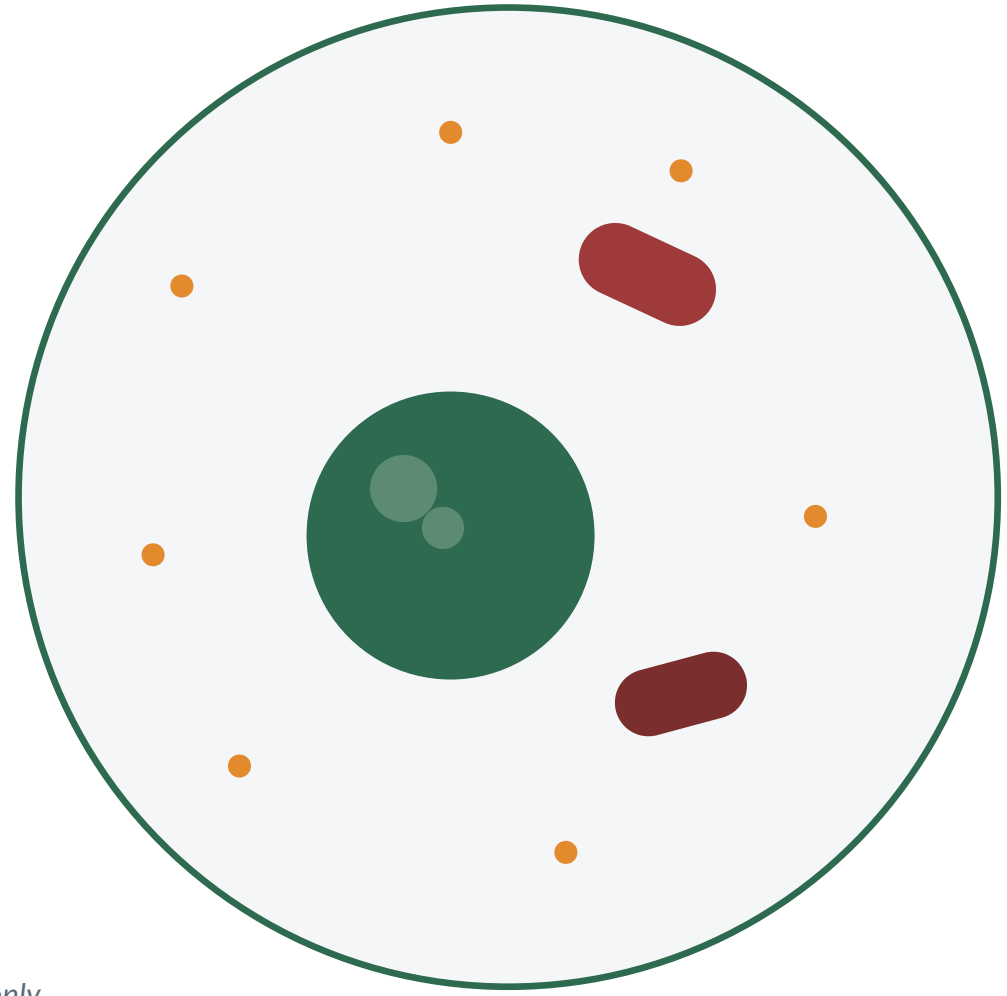
Teaching Deck 5 of 5 — Microorganisms

Covers Chunks 12–13: Culturing microorganisms · RP2: antiseptics/antibiotics

AQA 8461 | Edexcel 1BI0 | OCR J247 / J257

⚠️ BIOLOGY ONLY

Not required for Combined Science — separate Biology students only



Where we're going — 5 teaching decks

1 Cell types & structure

Chunks 1–3

1 Eukaryotes & prokaryotes

2 Animal & plant cells

3 Specialisation

2 Microscopy & RP1

Chunks 4–6

4 Light vs electron microscopy

5 Magnification maths

6 RP1: observing cells

3 Division & stem cells

Chunks 7–8

7 Mitosis & the cell cycle

8 Stem cells

4 Transport

Chunks 9–11

9 Diffusion

10 Osmosis + RP3

11 Active transport

BIO ONLY

THIS DECK

5 Microorganisms

Chunks 12–13

12 Culturing microorganisms

13 RP2: antiseptics/antibiotics

Teaching Deck 1 is the foundation — every structure named here gets reused for the rest of the topic.

Which slides do I need?

Each slide is labelled with the board it is for. Find your board, then skip the slides listed — they are not on your specification.

Your board	Slides to SKIP
AQA	None — every slide applies
EDEXCEL	None — every slide applies
OCR	None — every slide applies

Also: This whole deck is separate Biology only — Combined Science students stop after Deck 4. Question 4 on slide 10 is Higher tier. The final review slides apply to every board.

Last time — what do you remember?

Answer from memory first. No notes!

1. Define diffusion.

2. Which one of diffusion, osmosis and active transport needs energy, and where does the energy come from?

3. What is osmosis?

STARTER

~1 min

“Bacteria can double in number every 20 minutes if conditions are right. Starting from a single bacterium, how many would you have after 2 hours?”

Write your ideas in the box — we'll work it out properly next.

Growing bacteria

Binary fission

Bacteria multiply by simple cell division, as often as once every 20 minutes, given enough nutrients and a suitable temperature.

Growing cultures

In a nutrient broth solution, or as colonies on an agar gel plate. Uncontaminated cultures are essential — any contamination makes disinfectant/antibiotic results meaningless.

Maximum 25°C in school labs

Deliberately lower than body temperature (37°C), to minimise the growth of pathogens that could harm humans.

Aseptic technique

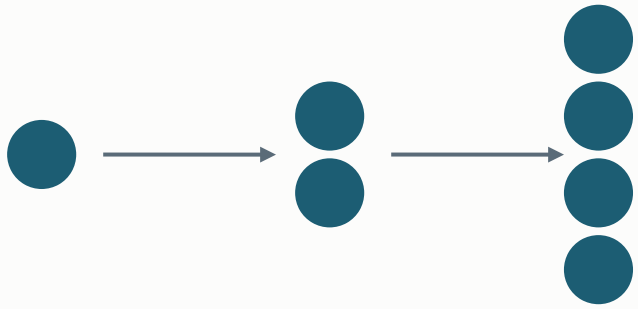
- Sterilise Petri dishes and culture media before use.
- Flame the inoculating loop before and after transferring microorganisms.
- Tape the lid — not sealed completely, so gas can still exchange.
- Store upside down, to stop condensation dripping onto the culture.

Why it matters: *aseptic technique keeps the culture pure and protects the student from infection.*

Two calculations to know

Population growth

number of bacteria = 2^n (n = number of divisions)

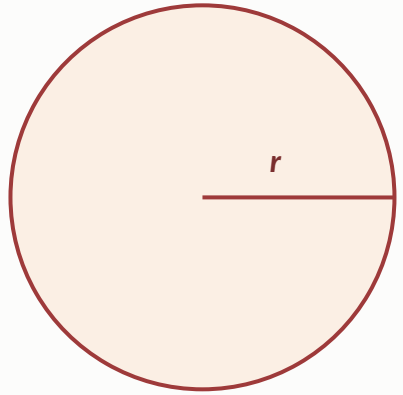


1 → 2 → 4 (after 2 divisions, $2^2 = 4$ bacteria)

AQA [HT]: express the answer in standard form where appropriate.

Area of a circle

area = πr^2



Used for: bacterial colony cross-sectional area, or a zone of inhibition around a disc (Chunk 13).

Remember: measure the DIAMETER, then halve it for r before squaring.

WORKED EXAMPLE

We model the method first — then you try

A single bacterium divides every 20 minutes. How many bacteria will there be after 1 hour, assuming ideal conditions throughout?

WORKING

1	**Convert time to divisions.**	1 hour = 60 minutes; 60 ÷ 20 = 3 divisions.
2	**Apply the formula.**	Number of bacteria = 2^n, with n = 3.
3	**Calculate.**	$2^3 = 8$.

Answer: 8 bacteria — 3 divisions in 1 hour, so $2^3 = 8$.

WORKED EXAMPLE

We model the method first — then you try

Describe how bacteria are cultured safely in a school laboratory, and explain why each precaution is needed. (6 marks)

WORKING

1	**The culture.**	Grow bacteria in nutrient broth or on an agar gel plate. Sterilise Petri dishes and culture media first, because any contamination makes results meaningless.
2	**Transferring and storing.**	Flame the inoculating loop before and after transferring; tape the lid (not sealed completely, so gas can exchange); store upside down so condensation does not drip onto the culture.
3	**Temperature.**	Incubate at a maximum of 25°C — lower than body temperature (37°C) — to minimise the growth of pathogens that could harm humans.

Answer: Bacteria are grown in nutrient broth or on an agar gel plate, after the Petri dishes and culture media have been sterilised so that the culture is not contaminated. The inoculating loop is flamed before and after transferring the microorganisms, the lid is taped on but not sealed completely so gas can still exchange, and the dish is stored upside down so condensation does not drip onto the culture. In school the culture is kept at a maximum of 25°C, lower than body temperature, to minimise the growth of pathogens that could harm humans.

YOUR TURN

Have a go before we check — answers on the next slide.

1. What is binary fission?

2. Give two reasons why aseptic technique is important when culturing bacteria.

3. Why are school laboratory cultures incubated at a maximum of 25°C rather than 37°C?

4. [Higher tier] A population of bacteria grows from 1 to 4096 in 4 hours. Calculate the mean division time, expressing your working in standard form where appropriate.

ANSWERS

Check your own work

1 Simple cell division in bacteria, producing two identical daughter cells.

2 Any two: prevents contamination that would invalidate results; prevents unwanted (possibly pathogenic) microorganisms growing; protects the student from infection.

3 To minimise the growth of microorganisms that could be pathogenic to humans, since 37°C is closer to body temperature and favours pathogen growth.

4 $4096 = 2^{12}$, so 12 divisions in 4 hours (240 minutes) = 240 ÷ 12 = 20 minutes per division (2×10^{1} minutes).

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Using elapsed time instead of number of divisions in 2^n.** Convert time to divisions first (divide by the division period), then apply the formula.
- ✖ **Assuming "OCR" covers this at the same point in both specs.** Gateway teaches it near the end of the course; 21st Century teaches it early — always check which spec.
- ✖ **Saying 37°C is used because it's "optimal for bacteria."** The real reason for the 25°C school limit is to minimise the growth of pathogens harmful to humans.

✅ IN A NUTSHELL

- Binary fission: simple cell division, as often as every 20 minutes.
- Aseptic technique: sterilise, flame the loop, tape the lid, store upside down.
- School cultures: max 25°C, to minimise pathogen growth.
- Number of bacteria = 2^n. Area of a colony/zone = πr^2.

NEXT Chunk 13 — RP2: antiseptics & antibiotics →

STARTER

~1 min

“A paper disc soaked in antibiotic is placed on a bacterial lawn. A clear circle appears around it overnight, with no bacteria growing inside it. What does that circle tell you?”

Write your ideas in the box — we'll name it precisely next.

Required practical — testing antiseptics and antibiotics

Method

Inoculate an agar plate with bacteria (e.g. a sterile spreader), then place paper discs soaked in different antiseptics, antibiotics or concentrations onto the agar. Use aseptic technique throughout — flame the loop, tape the lid, incubate upside down at a maximum of 25°C.

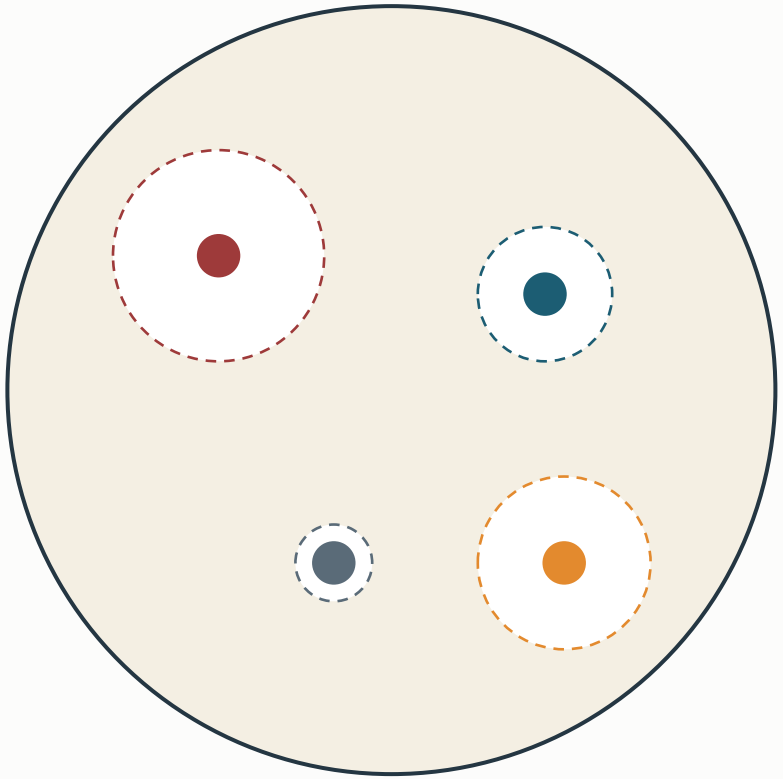
Zone of inhibition

A clear area forms around a disc where the antiseptic/antibiotic has killed or inhibited the bacteria — the larger the clear zone, the more effective that substance is.

Control disc

Soaked only in water, with no antiseptic/antibiotic — confirms that any zone of inhibition seen is due to the substance being tested, not some other factor.

A bacterial lawn with test discs



Larger clear zone = more effective substance.

WORKED EXAMPLE

We model the method first — then you try

A zone of inhibition around a disc has a diameter of 3.2 cm. Calculate its area.

WORKING

1	**Halve the diameter to get the radius.**	$3.2 \div 2 = 1.6$ cm.
2	**Apply the formula.**	Area $= \pi r^2 = \pi \times 1.6^2$.
3	**Calculate.**	$\pi \times 2.56 = 8.04$ cm² (3 s.f.).

Answer: 8.04 cm² (3 s.f.).

WORKED EXAMPLE

We model the method first — then you try

Describe how you would compare the effectiveness of two antibiotics using an agar plate, and how you would interpret the results. (6 marks)

WORKING

1	**Set up.**	Inoculate an agar plate with bacteria; place paper discs soaked in each antibiotic on the agar, plus a control disc soaked in water only. Use aseptic technique.
2	**Incubate and measure.**	Incubate upside down at a maximum of 25°C; measure each clear zone's diameter, halve it for the radius and use area = πr^2.
3	**Interpret.**	A larger zone of inhibition means a more effective substance. The control disc shows the zone is caused by the antibiotic itself.

Answer: Inoculate an agar plate with bacteria using aseptic technique, then place paper discs soaked in each antibiotic onto the agar, together with a control disc soaked only in water. Incubate the plate upside down at a maximum of 25°C, then measure the diameter of each clear zone, halve it to get the radius and calculate the area using πr^2. The antibiotic with the larger zone of inhibition is more effective, and the control disc confirms that the zone is due to the antibiotic being tested.

YOUR TURN

Have a go before we check — answers on the next slide.

1. Describe how you would set up an agar plate to compare the effectiveness of two different antibiotics.

2. What does a larger zone of inhibition indicate about an antiseptic's effectiveness?

3. Why should a control disc (soaked in water only) be included?

4. A zone of inhibition has a radius of 2.5 cm. Calculate its area.

ANSWERS

Check your own work

1 Inoculate the agar plate with bacteria, place paper discs soaked in each antibiotic onto the agar using aseptic technique, incubate at a maximum of 25°C, then measure the clear zones around each disc.

2 It indicates the antiseptic is more effective at killing/inhibiting the bacteria being tested.

3 To confirm that any zone of inhibition seen with the test substances is caused by that substance, not by some other factor (e.g. the disc itself, or moisture).

4 Area = $\pi r^2 = \pi \times 2.5^2 = \pi \times 6.25 = 19.6\ cm^2$ (3 s.f.).

Key terms for this deck

Term	Meaning
Binary fission	Bacteria multiply by simple cell division, as often as once every 20 minutes.
Nutrient broth	A solution in which bacteria can be grown.
Agar gel plate	A gel in a Petri dish on which bacteria grow as colonies.
Aseptic technique	Keeps the culture pure and protects the student from infection.
Inoculating loop	Flamed before and after transferring microorganisms.

Term	Meaning
25°C maximum	Used in school labs — lower than 37°C to minimise the growth of pathogens.
Population growth	Number of bacteria = 2^n, where n is the number of divisions.
Area of a circle	πr^2 — halve a measured diameter to get r first.
Zone of inhibition	A clear area around a disc where the antiseptic/antibiotic has killed or inhibited the bacteria.
Control disc	Soaked only in water — confirms any zone is due to the substance being tested.

Watch out — and what to remember

⚠️ COMMON SLIP-UPS

- ✖ **Using the diameter directly as r in πr^2.** Always halve a measured diameter to get the radius before squaring.
- ✖ **Forgetting the control disc.** An easy method-mark — without it, you can't confirm the zone is due to the substance being tested.
- ✖ **Saying a bigger zone means "more antibiotic used."** It means the substance is more EFFECTIVE against that bacteria, not that more of it was used.

✅ IN A NUTSHELL

- Zone of inhibition: clear area where bacteria were killed/inhibited.
- Larger zone = more effective substance.
- Always include a control disc (water only).
- Area = πr^2 — halve a given diameter to get r first.

NEXT Whole-topic review →

Common mistakes — across all 13 chunks

- **Mixing up magnification and resolution.** A higher magnification does not automatically mean more detail is visible — resolution is what determines detail. A very common way to lose an “explain” mark.
- **Forgetting to convert units before a magnification calculation.** Image size and real size must share a unit before dividing — the single biggest source of dropped marks in this topic.
- **Learning the named stages of mitosis when your board doesn't need them.** Interphase/prophase/metaphase/anaphase/telophase is Edexcel-only — AQA and both OCR specs need just the three broad stages.
- **Confusing diffusion and osmosis.** Osmosis is specifically water, across a partially permeable membrane — a special case of diffusion, not a separate process.
- **Assuming “OCR” means one thing.** Gateway and 21st Century genuinely disagree — water potential terminology and the timing of culturing microorganisms are the two biggest traps.

WORKED EXAMPLE

We model the method first — then you try

A root hair cell takes in water and mineral ions from the soil. Explain how the cell is adapted to do this, and describe how each substance moves in. (6 marks)

WORKING

1 **The adaptation.**

A root hair cell has a long, thin extension, which increases its surface area, so water and mineral ions are taken up faster.

2 **Water.**

Water moves in by osmosis — the diffusion of water from a dilute to a more concentrated solution through a partially permeable membrane. No energy is needed.

3 **Mineral ions.**

Taken in by active transport, from very dilute soil solutions, against the concentration gradient. This needs energy, supplied by respiration.

Answer: A root hair cell has a long, thin extension that increases its surface area, so water and mineral ions are taken up faster. Water moves in by osmosis, the diffusion of water from a more dilute to a more concentrated solution through a partially permeable membrane, which needs no energy. Mineral ions are taken in by active transport from very dilute soil solutions, against the concentration gradient, which needs energy supplied by respiration.

EXIT QUESTIONS

Pull together — answers on the next slide

1. A cell has a real width of 25 µm and appears 5 mm wide in a photo. Calculate the magnification.

2. Name the three overall stages of the cell cycle. [Edexcel only] Name the six named cell-cycle stages, from interphase to cytokinesis.

3. [Biology only] A zone of inhibition around an antibiotic disc has a radius of 1.8 cm. Calculate its area.

4. A potato cylinder's mass changes from 6.0 g to 5.4 g after time in a salt solution. Calculate the % change in mass, and explain the result in terms of osmosis.

5. Give one similarity and one difference between diffusion and active transport.

ANSWERS

Check your own work

1 5 mm = 5000 µm; magnification = 5000 ÷ 25 = ×200.

2 Growth/DNA replication; division of the nucleus; division of the cytoplasm and membranes. Edexcel: interphase, prophase, metaphase, anaphase, telophase, cytokinesis.

3 Area = $\pi r^2 = \pi \times 1.8^2 = \pi \times 3.24 = 10.2\ cm^2$ (3 s.f.).

4 % change = (5.4 − 6.0) ÷ 6.0 × 100 = −10%; the salt solution was more concentrated than inside the potato cells, so water left the cells by osmosis, causing a loss in mass.

5 Similarity: both move substances across cell membranes / both can happen simultaneously in the same cell. Difference: diffusion moves down a concentration gradient and needs no energy; active transport moves against the gradient and requires energy from respiration.

GCSE2MED

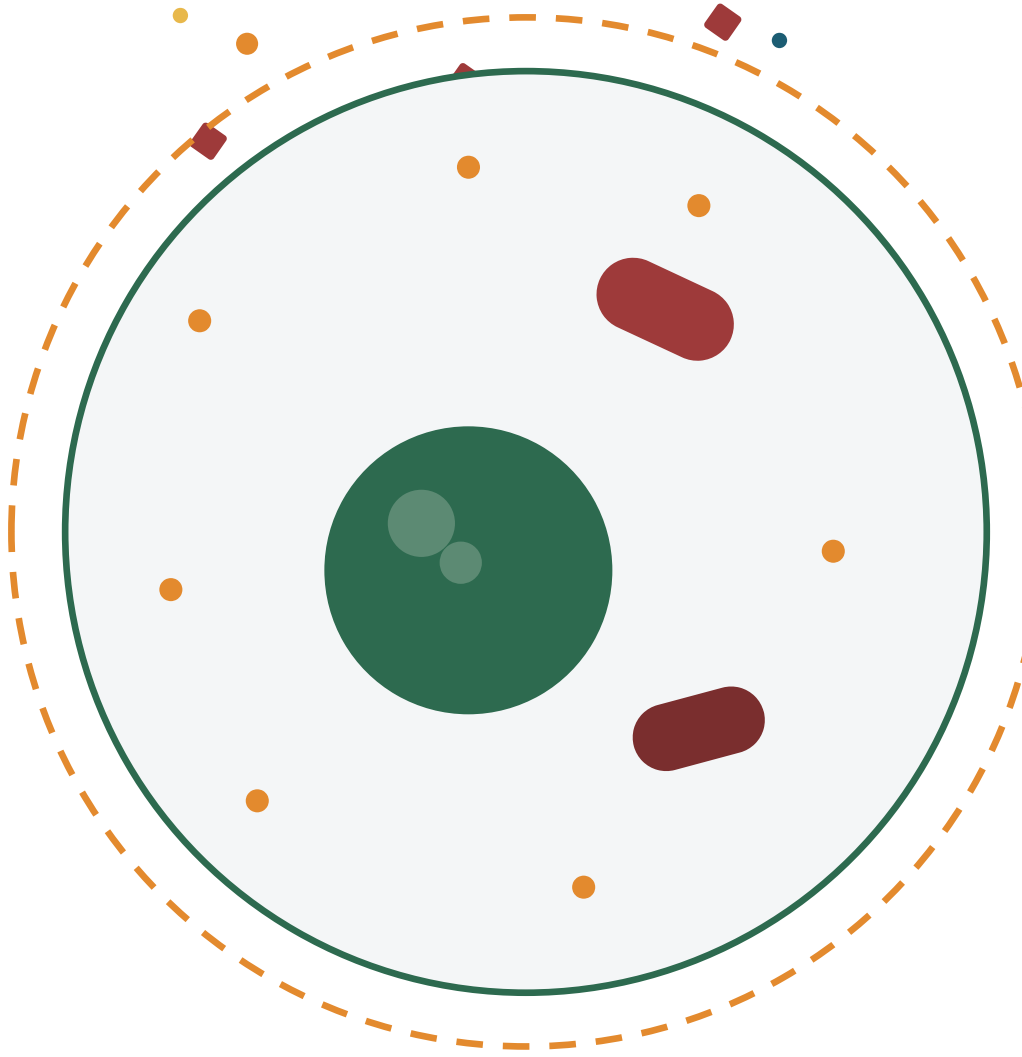
★ TOPIC COMPLETE ★

Cell Biology

Well done — you've completed the whole topic, start to finish!

5 / 5 teaching decks · 13 / 13 chunks · 100%

- 1. Cell types & structure
- 2. Microscopy & RP1
- 3. Division & stem cells
- 4. Transport
- 5. Microorganisms (Biology only)



Nucleus to antibiotics — next stop, past papers.