

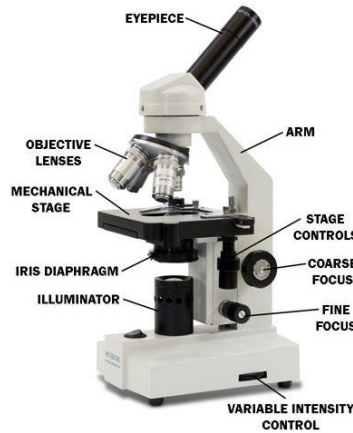
## B1: Biology key concepts Knowledge Organiser

### Lesson sequence

1. Microscopes
2. Plant and animal cells
3. Measuring cells
4. Core practical: using microscopes
5. Specialised cells
6. Bacterial cells
7. Digestive enzymes
8. How enzymes work
9. Factors affecting enzymes
10. Core practical: enzymes and pH
11. Cell transport
12. Core practical: osmosis in potatoes

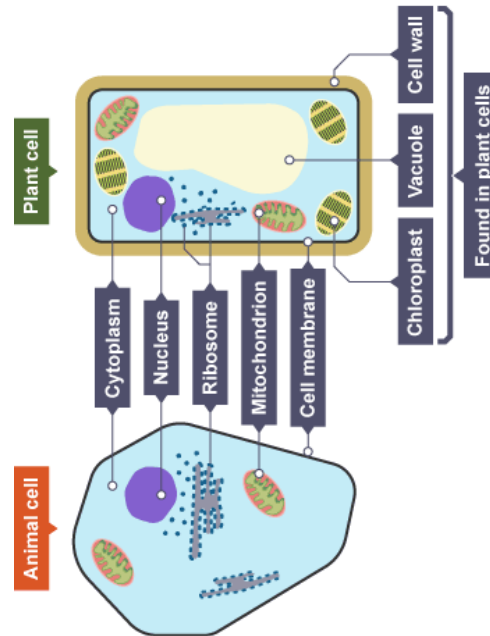
#### 1. Microscopes

<b>*Magnification</b>	The number of times bigger something appears under a microscope.
<b>*Eyepiece lens</b>	The lens on a microscope that you look through.
<b>*Objective lens</b>	The lens at the bottom of a microscope. There are normally three you can choose from.
<b>*Total magnification</b>	Eyepiece lens x objective lens.
<b>**Resolution</b>	The smallest distance between two points so that they can still be seen as two separate points.
<b>**Stains</b>	Dyes added to microscope slides to show the details more clearly.
<b>**Milli</b>	Thousandth, $1 \times 10^{-3}$ (a millimetre is a thousandth of a metre).
<b>**Micro</b>	Millionth, $1 \times 10^{-6}$ (a micrometre is a millionth of a metre).
<b>**Nano</b>	Billionth, $1 \times 10^{-9}$ (a nanometre is a billionth of a metre).
<b>**Pico</b>	Trillionth, $1 \times 10^{-12}$ (a picometre is a trillionth of a metre).



#### 2. Plant and animal cells

<b>*Cell</b>	The basic structural unit of all living things (the building blocks of life).
<b>*Parts of an animal cell</b>	Cell membrane, cytoplasm, nucleus, ribosomes, mitochondria.
<b>*Parts of a plant cell</b>	Cell membrane, cytoplasm, nucleus, ribosomes, mitochondria, cell wall, permanent vacuole, chloroplasts.
<b>*Cell membrane</b>	Controls what enters and leaves the cell.
<b>*Cytoplasm</b>	A jelly-like substance where chemical reactions take place.
<b>*Nucleus</b>	Contains DNA and controls the cell.
<b>*Ribosome</b>	Produces proteins.
<b>*Mitochondria</b>	Releases energy by aerobic respiration.
<b>*Cell wall</b>	Protects and supports the cell, made of cellulose.
<b>*Permanent vacuole</b>	Stores sap and helps to support the cell.
<b>*Chloroplast</b>	Where photosynthesis happens, contains chlorophyll.



#### 3. Measuring cells

<b>*Micrograph</b>	A picture produced by a microscope.
<b>*Light microscope</b>	A microscope that uses light, can magnify up to 1500 times.
<b>**Electron microscope</b>	A microscope that uses electrons to produce an image, can magnify up to 1,000,000 times.
<b>**Actual size of a cell</b>	Actual size = measured size / magnification
<b>**Convert mm to <math>\mu\text{m}</math></b>	Micrometres ( $\mu\text{m}$ ) = millimetres (mm) x 1000

#### 4. Core practical – using microscopes (CP1)

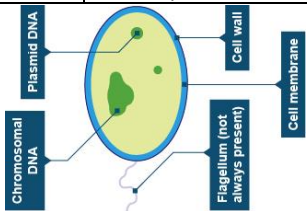
<b>*CP1 – key question</b>	What do cells look like under a light microscope?
<b>*CP1 – Prepare the slide</b>	Collect the cells you are studying and place them on the slide. Add a drop of stain and cover with a cover slip.
<b>*CP1 – Select lens</b>	Choose between the 4x, 10x and 40x objective lenses.

<b>*CP1 – Place slide in microscope</b>	Place slide on microscope stage, adjust the coarse focus until the lens is just touching the slide.
<b>*CP1 – Rough focus</b>	Looking through the eyepiece, slowly adjust the coarse focus until you see a rough image.
<b>*CP1 – Fine focus</b>	Looking through the eyepiece, slowly adjust the fine focus until you see a sharply focussed image.
<b>*CP1 – Record the image</b>	Draw what you see, label any cell parts you can recognise and repeat with different objective lenses.
<b>*CP1 - Results</b>	As you increase the magnification of the objective lens, the cells appear larger and more detailed.

#### 5. Specialised cells

<b>**Small intestine cell</b>	<b>Job:</b> To absorb small food molecules produced during digestion. <b>Adaptations:</b> Tiny folds called microvilli that increase their surface area.
<b>**Sperm cell</b>	<b>Job:</b> Fertilise an egg and deliver male DNA. <b>Adaptations:</b> A tail to swim, mitochondria to give energy for swimming, an acrosome to break through the egg's jelly coat, haploid nucleus with only half the total DNA.
<b>**Egg cell</b>	<b>Job:</b> To be fertilised by a sperm and then develop into an embryo. <b>Adaptations:</b> Jelly coat to protect the cell, many mitochondria and nutrients to provide energy for growth, haploid nucleus with only half the total DNA.
<b>**Ciliated epithelial cell</b>	<b>Job:</b> To clear mucus out of your lungs (and other internal surfaces). <b>Adaptations:</b> Small hairs on the surface – called cilia – which wave to sweep mucus along.

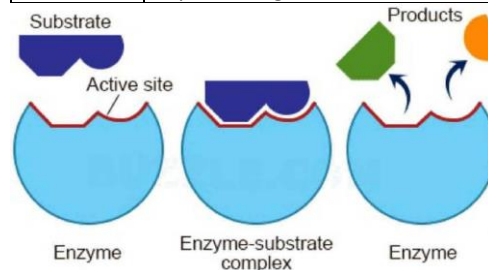
6. Bacterial cells	
<b>*Parts of a bacterial cell</b>	<b>All bacteria:</b> Cell membrane, cell wall, cytoplasm, ribosomes, chromosomal DNA, plasmid DNA <b>Some bacteria:</b> flagellum.
<b>**Chromosomal DNA</b>	Large piece of DNA containing most genes.
<b>**Plasmid DNA</b>	Small loops of DNA containing a few genes.
<b>**Flagellum</b>	A tail used for movement.
<b>**Eukaryotic cells</b>	Cells with a nucleus.
<b>**Prokaryotic cells</b>	Cells without a nucleus.
<b>***Standard form</b>	A way of writing numbers in terms of powers of ten. E.g.  $0.015 = 1.5 \times 10^{-2}$ $0.000458 = 4.56 \times 10^{-4}$  The index of ten (the 'minus' number) tell you which decimal point to start on.



7. Digestive enzymes	
<b>*Digestion</b>	Breaking large food molecules down into ones small enough to be absorbed by the small intestine.
<b>*Catalyst</b>	A substance that speeds up a chemical reaction without being used up.
<b>*Enzyme</b>	A protein that works as a catalyst to speed up the reactions in our cells.
<b>*Digestive enzymes</b>	Enzymes that break large food molecules down into smaller ones.

<b>**Amylase</b>	<b>Where found:</b> saliva, small intestine <b>What it does:</b> breaks down starch into simple sugars such as maltose
<b>**Lipase</b>	<b>Where found:</b> small intestine <b>What it does:</b> breaks down fats into fatty acids and glycerol
<b>**Protease</b>	<b>Where found:</b> stomach (pepsin), small intestine (trypsin) <b>What it does:</b> breaks down proteins into amino acids

8. How enzymes work	
<b>*Substrate</b>	The chemical(s) that an enzyme works on.
<b>*Active site</b>	An area of an enzyme with the same shape as the substrate.
<b>**Lock and key mechanism</b>	The substrate moves into the active site and reacts to form the products. The products leave the active site so another substrate can then enter and so on.
<b>**Specificity</b>	Each enzyme can only work on one substrate because the shape of the active site has to match.
<b>*Denature</b>	When the shape of the active site changes shape so the enzyme stops working.



9. Factor affecting enzymes	
<b>*Optimum temperature</b>	The temperature when an enzyme works fastest (about 37° for human enzymes).
<b>**Changing the temperature</b>	<b>Increasing to optimum:</b> rate increases because particles move faster <b>Increasing past optimum:</b> rate decreases as enzyme denatures

<b>*Optimum pH</b>	The pH when enzymes work fastest (around pH 6-8 for most human enzymes)
<b>**Changing pH</b>	Rate decreases as you move away from the optimum because the enzyme denatures.
<b>**Increasing substrate concentration</b>	At first the rate increases, but then it levels out as the enzyme is working as fast as possible.

10. Core practical – enzymes and pH (CP2)	
<b>*CP2 – key question</b>	How does the rate that amylase works change as you change the pH?
<b>*CP2 – Prepare your reactants</b>	Place starch solution, amylase solution and pH 7 buffer into separate test tubes and warm them in a water bath at 40°C
<b>*CP2 – Prepare your dropping tile</b>	Place a few drops of iodine solution into each well of a spotting tile.
<b>*CP2 – Start the reaction</b>	Mix reactants together, start the stop watch and keep the mixture warm in the water bath.
<b>*CP2 – Test for starch</b>	Remove a small amount of mixture and place in a well on the spotting tile.
<b>*CP2 – Record your results</b>	Repeat the test until the mixture does not go black (no starch). Record the time.
<b>*CP2 – Vary the pH</b>	Repeat with different pH buffers from pH 3 to pH 10
<b>*CP2 – Results</b>	The amylase works fastest around pH 7 and more slowly at pH high or lower than this.

11. Cell transport	
<b>*Concentration</b>	The number of particles in a given volume (the strength of a solution).
<b>**Concentration gradient</b>	The difference in concentration between two neighbouring areas.
<b>*Diffusion</b>	The movement of particles from high to low concentration (down a concentration gradient).

<b>*Diffusion examples</b>	<b>Lungs:</b> oxygen into blood, carbon dioxide out of blood <b>Leaf:</b> carbon dioxide into leaf, oxygen out of leaf.
<b>**Partially permeable membrane</b>	A membrane that allows some molecules but not others to pass through it (like a cell membrane).
<b>**Osmosis</b>	The movement of water across a partially permeable membrane from high water/low solute conc to low water/high solute conc.
<b>**Osmosis examples</b>	Water into plant roots, water in/out of any cells.
<b>*Active transport</b>	Using energy to move substances from low to high concentration (up a concentration gradient).
<b>*Active transport examples</b>	Minerals being absorbed into plant roots.

12. Core practical – osmosis in potatoes (CP3)	
<b>*CP3 – Prepare potatoes</b>	Cut six similar pieces of potato, blot them dry and weigh them.
<b>*CP3 – Run the experiment</b>	Place each potato piece in a test tube with sucrose (sugar) solutions with concentrations from 0% to 50%
<b>*CP3 – Record results</b>	Blot each potato piece dry and re-weigh it.
<b>*CP3 – Calculate percentage mass change</b>	% change = (final value – starting value) / starting value x 100
<b>*CP3 – Results</b>	Potato in weaker sucrose solutions gain mass because water enters potatoes by osmosis, those in stronger solutions lose mass as water leaves by osmosis.