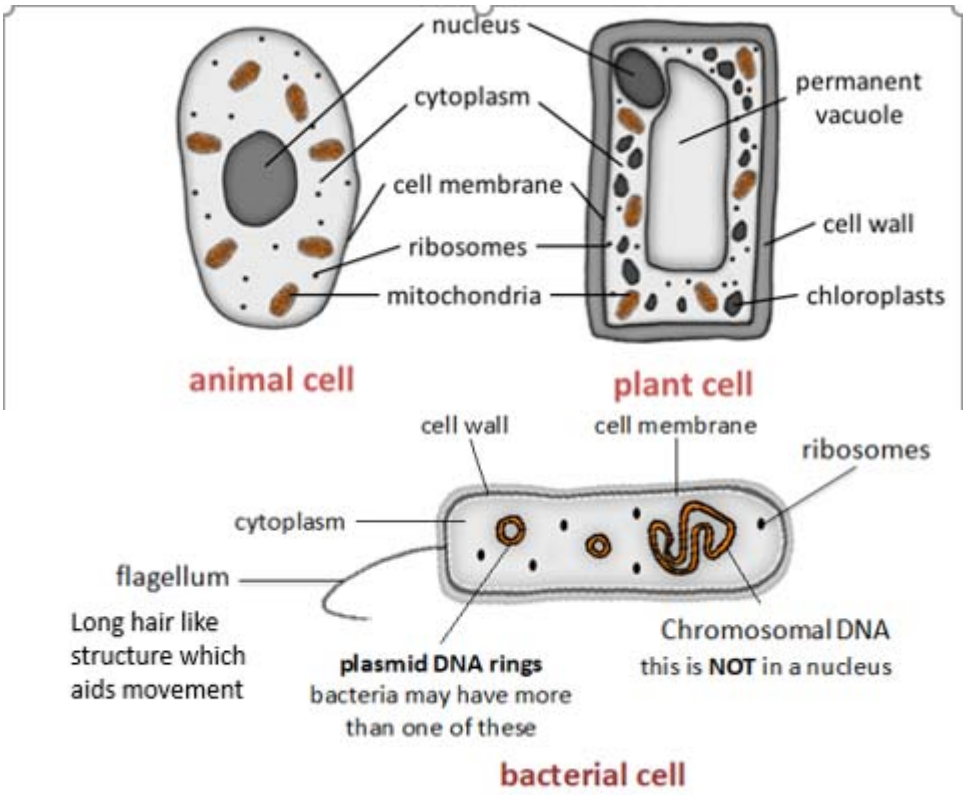
All living things are made of cells; they are the basic unit of all life.
Eukaryotic Cells: have a cell membrane, cytoplasm and genetic material (DNA) enclosed in a **nucleus**. Examples: plant and animal cells

Prokaryotic Cells: **No nucleus**. DNA is a single loop. There maybe one or more rings of DNA called plasmids. Examples: Bacteria cells

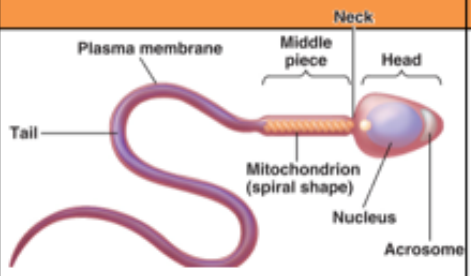
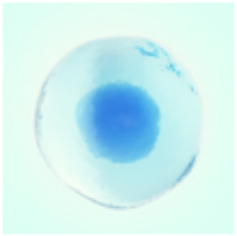


You need to be able to list the similarities and differences of an animal, plant and bacterial cell

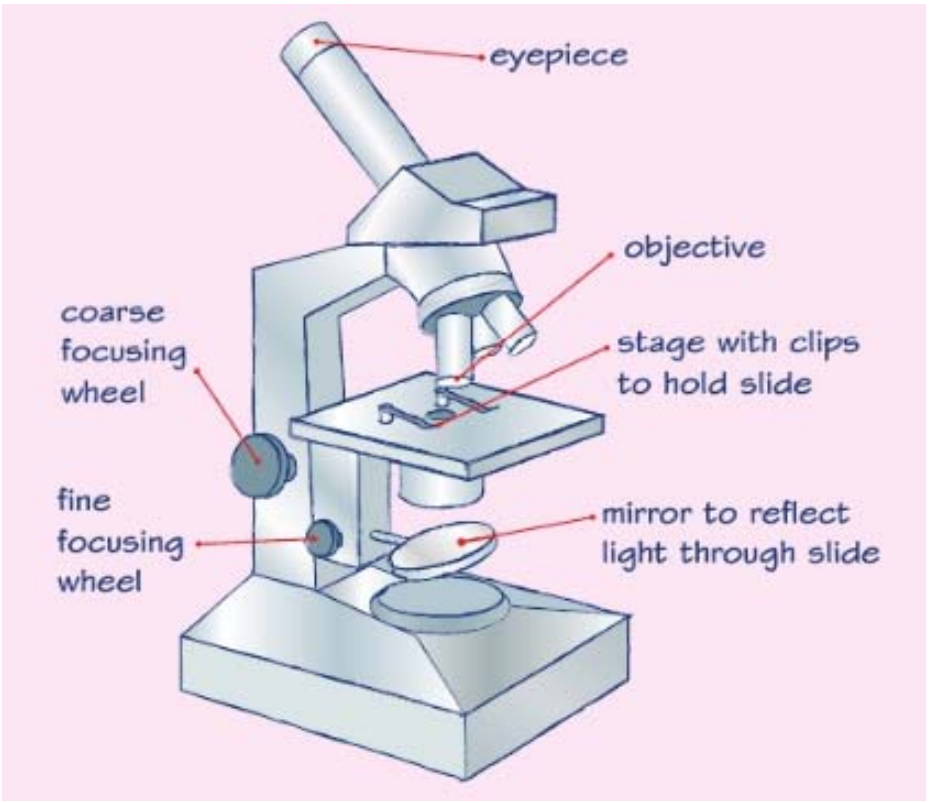
Cell part	Function	Animal	Plant	Bacteria
Nucleus	Contains genetic material which controls the activities of the cell	✔	✔	
Cytoplasm	Most chemical processes take place here, controlled by enzymes	✔	✔	✔
Cell membrane	Controls movement of substances into and out of cell	✔	✔	✔
Mitochondria	Most energy is released by respiration here	✔	✔	
Ribosomes	Protein synthesis happens here	✔	✔	✔
Cell wall	Strengthens the cell – made of cellulose (not bacteria) algal cells also have a cell wall		✔	✔
Chloroplasts	Contain chlorophyll, absorbs light energy for photosynthesis		✔	
Permanent vacuole	Filled with cell sap to help keep the cell turgid		✔	
Chromosomal DNA	Loop of DNA NOT found in a nucleus			✔
Plasmid (DNA)	Small ring of DNA often used as a vector in genetic modification			✔

Specialised Cells (3 types)

The **structure** of different cells helps them to carry out a **particular function** within the organism. These cells are called **specialised cells.**

Name of animal cell	Diagram	Adaptation to function
Sperm		**Function is to fertilise an egg** • Streamlined with a long tail to swim to the egg • Acrosome in the head containing enzymes to digest the egg cell membrane • Large number of mitochondria in the mid section to release energy for movement • Ribosomes for protein synthesis
Egg		**Function is to fuse with sperm and develop into embryo** • Nutrients in the cytoplasm for respiration and cell division • Haploid nucleus • Cell membrane changes to prevent further sperm entry
Ciliated epithelium		**Function is movement of substances** • Surface contains cilia (microscopic hairs) to sweep substances e.g. mucus • Large number of mitochondria to release energy

Microscopes



2 types of microscopes : Light microscope and electron microscope

Feature	Light (optical) microscope	Electron microscope
Radiation used	Light rays	Electron beams
Max magnification	~ 1500 times	~ 2 000 000 times
Resolution	200nm	0.2nm
Size of microscope	Small and portable	Very large and not portable
Cost	~£100 for a school one	Several £100,000 to £1 million plus

$$\text{magnification } M = \frac{\text{size of image I}}{\text{real size of the object A}}$$

MAGNIFICATION: the number of times bigger the image looks compared to the object
IMAGE: what is viewed through the microscope lenses
OBJECT: the **ACTUAL** specimen under microscope.
Make sure the image and object size have the same units.

Example: A magnified animal cell structure has a diameter of 6 mm.
The actual diameter of the structure is 0.15mm.
Calculate how many times the structure has been magnified.

Units used to measure cells

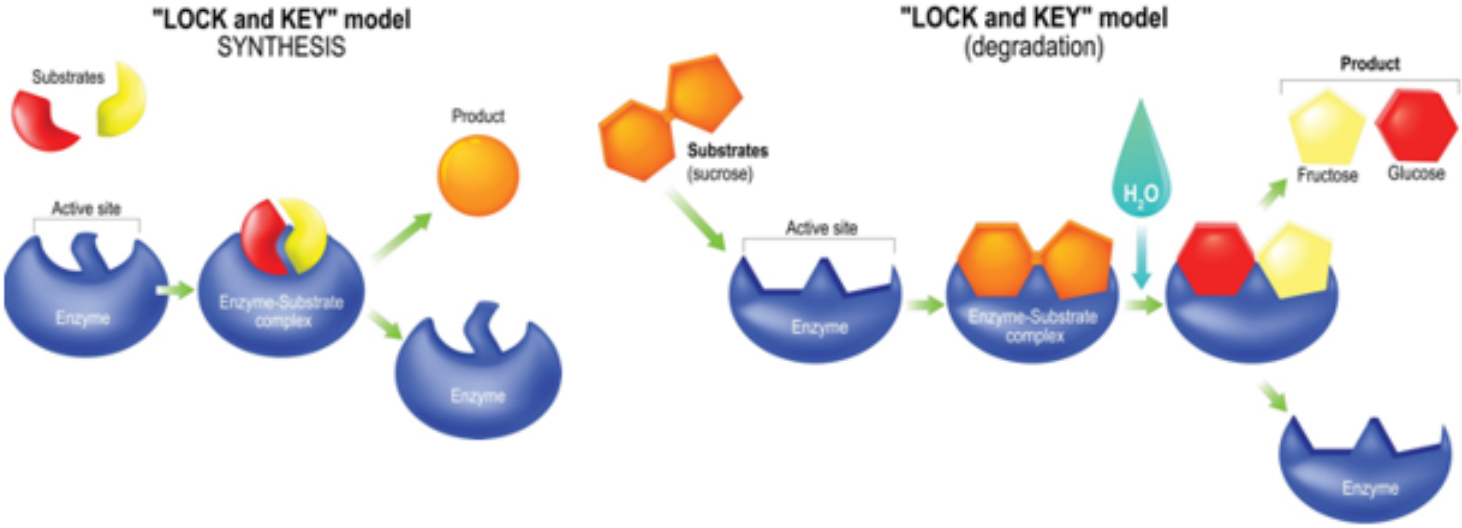
Prefix	Multiple	Standard form
centi (cm)	1 cm = 0.01 m	$\times 10^{-2}$
milli (mm)	1 mm = 0.001 m	$\times 10^{-3}$
micro (µm)	1 µm = 0.000 001 m	$\times 10^{-6}$
nano (nm)	1 nm = 0.000 000 001 m	$\times 10^{-9}$
pico (pm)	1 pm = 0.000 000 000 001m	$\times 10^{-12}$

Enzymes

Enzymes are biological catalysts. A **catalyst** is something that speeds up or slows down a reaction without get involved in the reaction.

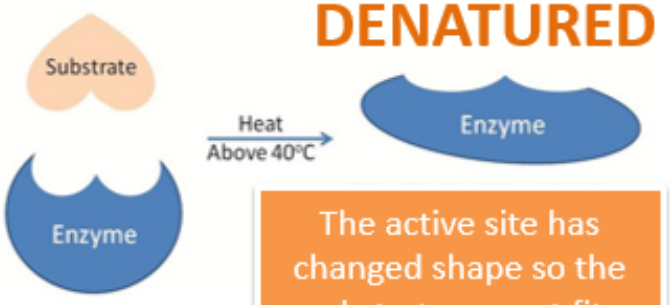
Enzymes are **specific** to a substrate. The activity of an enzyme is affected by temperature, substrate concentration and pH. Specific conditions are needed to keep an enzyme working at its optimum.

'Lock and Key theory' is a **model** to explain **enzyme action.** **Enzymes** are made of **proteins** and are **biological catalysts** - substances that **increase** the rate of **chemical reactions** without being **used up**. The shape of the **active site** of the enzyme is specific for each substrate (substance the enzyme acts on).



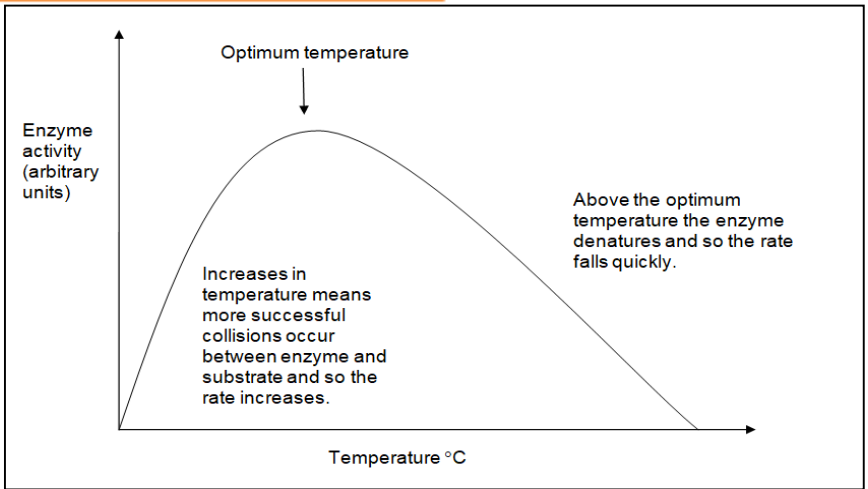
The **products** of digestion are used to **build** new **carbohydrates**, **lipids** and **proteins** in the body. Some **glucose** is used in **respiration**.

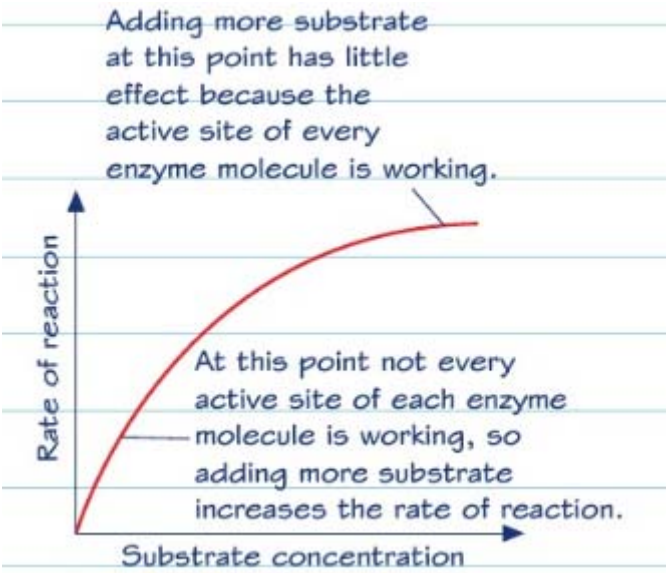
In enzyme reactions, **increasing the temperature** will initially increase the **rate of reaction** due to increased **collisions** between the enzyme and substrates. **BUT** if the **temperature** is **too high** the **enzyme** will **denature** because some of the bonds in the protein break so changing its shape.

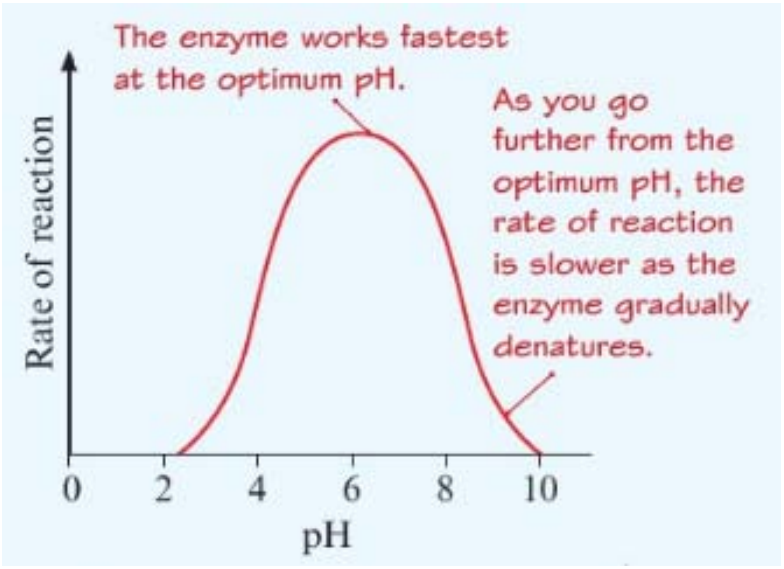


DENATURED

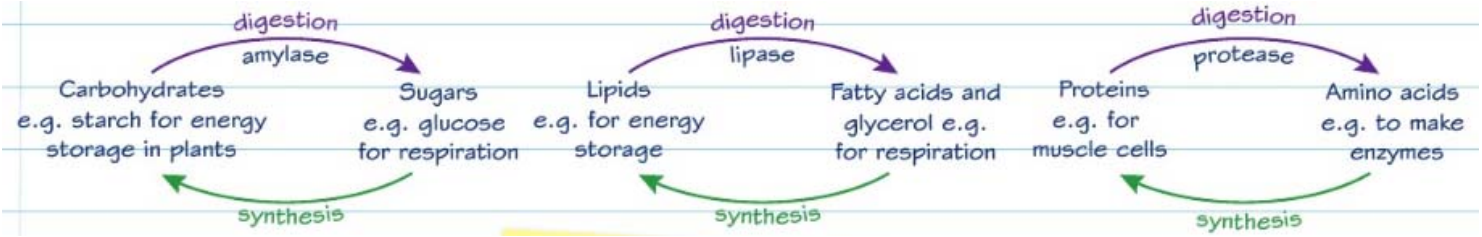
The active site has changed shape so the substrate cannot fit.







Digestive Enzymes

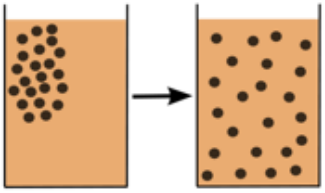


How substances are transported in and out of cells

Diffusion

Diffusion is the spreading of the **particles of a gas or substances in solution**, resulting in a **net movement** of particles from a region where they are of a **higher concentration** ***to an area of*** **lower concentration.**

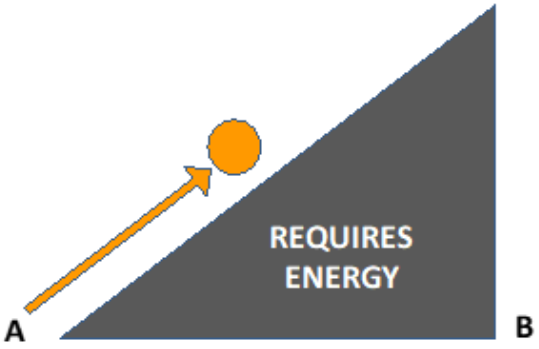
Diffusion can occur in: Air – smells from perfume etc.
Solution – tea from a tea bag, dye in water etc.
Through membranes – small intestines, blood cells etc.

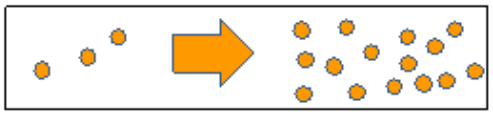


Substances that are transported in and out of cells in humans			
Location	Particles move	From	To
Small Intestine 	**Digested food e.g. glucose, amino acids**	**Small intestine**	**Blood in capillary of villus**
Lungs 	**Oxygen**	**Alveolar air space**	**Blood circulating around the lungs**
Kidneys 	**Urea**	**Cells**	**Blood plasma**

Active Transport

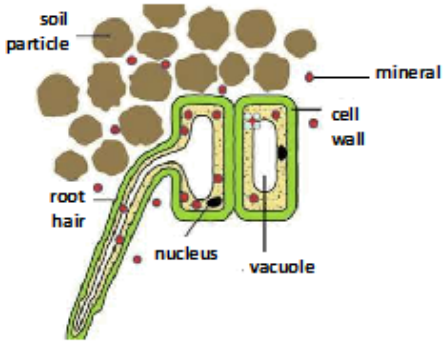
Active transport moves substances from a more dilute solution to a more concentrated solution (against a concentration gradient). The energy is provided by respiration.





lower concentration — higher concentration

Active transport occurs in **root hair cells**.



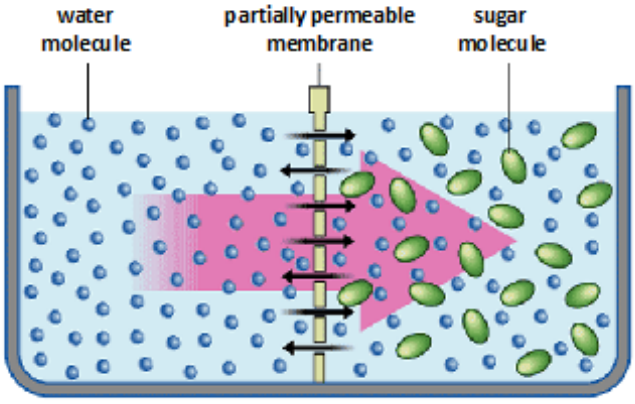
The **minerals** are at a **higher concentration** in the **root hair** cell than in the soil. So the **minerals** move **into** the **cell against** the concentration gradient.

Active transport also occurs in the **gut** (small intestines); **sugar** (glucose) molecules are absorbed from lower concentrations in the gut into the blood which has a higher sugar concentration.

The glucose is used for respiration.

Osmosis

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

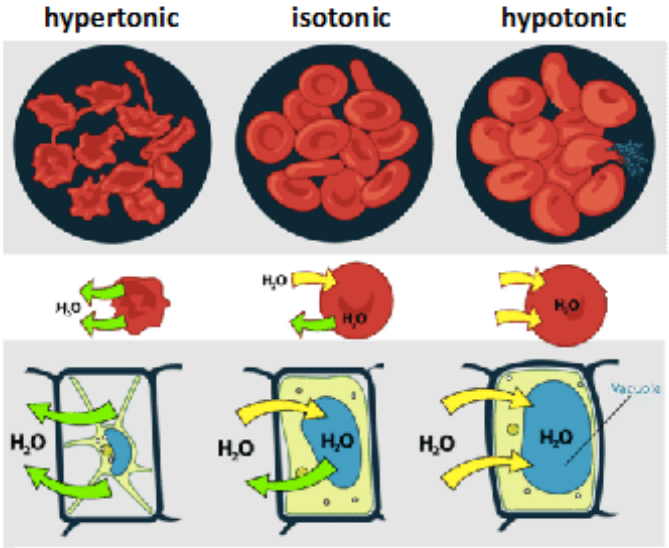


water moves from the dilute side to the more concentrated side

The **rate** of **osmosis** changes depending on the **concentration gradient** and **temperature**.

Partially permeable membrane – a membrane that lets some but not all substances through.

Osmosis in plant and animal cells:



Hypertonic – **more concentrated** solution than in the cells.

Isotonic – **same concentration** as the solution in the cell.

Hypotonic – **more dilute** than the solution in the cells.

The initial mass of a potato slice was 16.52 g. After soaking in a solution the final mass was 20.15 g. Calculate the percentage change in mass.