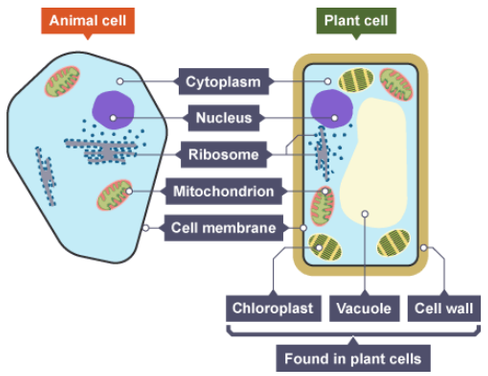
Cell Biology

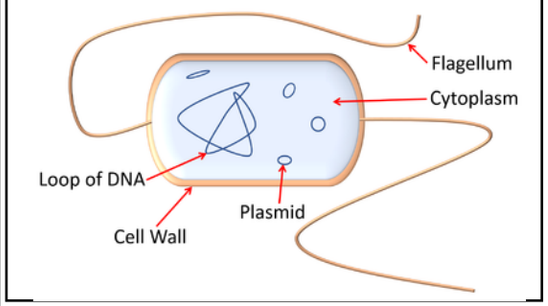
Below is a checklist of everything you need to know for this topic:

	Structure of plant and animal (eukaryotic) cells
	Structure of prokaryotic cells
	The function of subcellular organelles in cells
	Calculate magnification, image size and actual size
	Explain how sperm, nerve and muscle cells are adapted to their function
	Explain how root hair cells, xylem and phloem cells are adapted to their function
	Explain why cell differentiation is important
	Define what is meant by a specialised cell
	Describe how bacteria replicate
	Describe how to prepare an uncontaminated sample
	Calculate the zones of inhibition
	Calculate the number of bacteria in a population in a given time
	Describe the stages of the cell cycle
	Explain why mitosis and meiosis are both important
	Define what is meant by a stem cell
	Describe the function of stem cells in different organisms
	Describe the process of therapeutic cloning
	Evaluate the use of stem cells
	Define diffusion, osmosis and active transport
	Describe how different factors affect diffusion
	Explain the effect of surface area to volume ratio on exchanging materials

Plant and Animal cells



Prokaryotic Cells



Organelle Functions

Nucleus	Contains genetic information, controls the cell
Cell membrane	Controls what can enter and leave the cell
Cytoplasm	Where most chemical reactions take place
Ribosomes	Where protein synthesis takes place
Mitochondria	Releases energy through respiration
Cell wall	Strengthens and supports the cell
Chloroplasts	Where photosynthesis takes place
Permanent Vacuole	Filled with cell sap (a solution of sugar, salts and water)

Microscopy Calculations

Image size = Actual size x Magnification

Actual size = Image size ÷ Magnification

Magnification = Image size ÷ Actual size

Using a Microscope

- Use a cover slip to avoid the lens getting damaged or stained
- Make sure the lens **does not touch** the sample to avoid it getting scratched
- Focus it first on the **lowest magnification**
- The **objective lens** changes the magnification
- The **fine focus** makes the image clearer

Transport in Cells

Diffusion – Movement of particles from a high to low concentration (E.g. oxygen in to the lungs, carbon dioxide in to the leaf)

Osmosis – Movement of water from a high to low concentration through a semi-permeable membrane (E.g. water in to root hair cells)

Active Transport – Movement of molecules from a low to high concentration. Requires energy (E.g. minerals in to root hair cells, glucose in to the blood from the small intestine

Factors affecting diffusion

Temperature – As temperature increases, rate of diffusion increases as molecules have more energy.

Concentration Gradient – The greater the gradient (difference in concentration), the faster diffusion takes place.

Surface Area of Membrane – The larger the surface area of the membrane, the longer it takes for diffusion to occur as particles have further to travel.

Specialised Cells

Cells that are adapted to a specific function.

Cells become specialised when they go through a process called **differentiation.**

- Most types of animal cells differentiate early on (while it is still an embryo)
- Most plant cells keep the ability to differentiate throughout their life (meristem cells)

When a cell differentiates, it acquires different organelles (e.g. mitochondria, ribosomes) to help it carry out its function.

Stem Cells

Cells that are **undifferentiated** and can turn in to any type of cell.

In **adults** they are found in marrow but these can **only become blood cells.**

In **plants** they are called **meristem cells** and found in the **root, fruit and shoot tips.**

Mitosis

Cell division to produce **genetically identical cells**

1. DNA and organelles replicate
2. Chromosomes are pulled apart
3. New two nuclei and cell membranes form

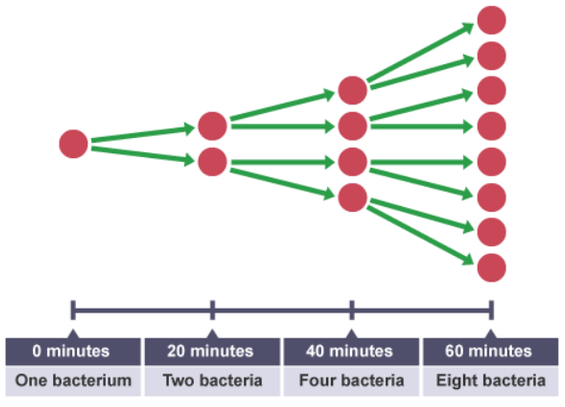
Meiosis

Cell division to produce **gametes** (E.g. sperm and egg, pollen and egg)

Cells contain **half the number** of chromosomes – the **full number is restored at fertilisation**

Binary Fission

Bacteria can replicate **every 20 minutes** if the condition is correct by a process called **binary fission.**



Surface Area to Volume Ratio

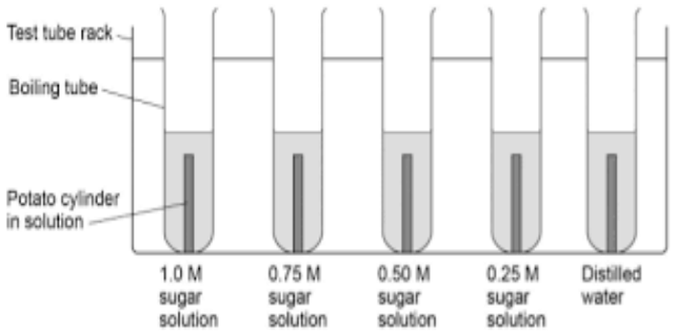
When the **size of an organism increases,** it's surface area to volume **ratio decreases.**

This means there are **more cells on the inside** compared to the outside.

This is why **multicellular organisms need specialised exchange systems.**

In **unicellular organisms,** diffusion is sufficient

Osmosis Required Practical



Variables

Independent variable (the thing that you change) – the concentration of the sugar or salt solution

Dependent variable (the thing that you measure) – the percentage change in mass

Control variables (the things that you keep the same)
- Temperature
- Time
- Volume of solution
- Length of potato chip

We **dry the potato chips** before weighing them to **remove any excess water** that could affect the results.

We measure **percentage change in mass** instead of just change in mass.

This is because all the potatoes have **different starting masses** and so gives us a valid comparison.

% change = (change ÷ original) x 100

If a potato is placed in a **high sugar or salt concentration** solution, it will **lose mass** as it loses water through osmosis.

This is because **there is more water in the potato chip** compared to the solution.

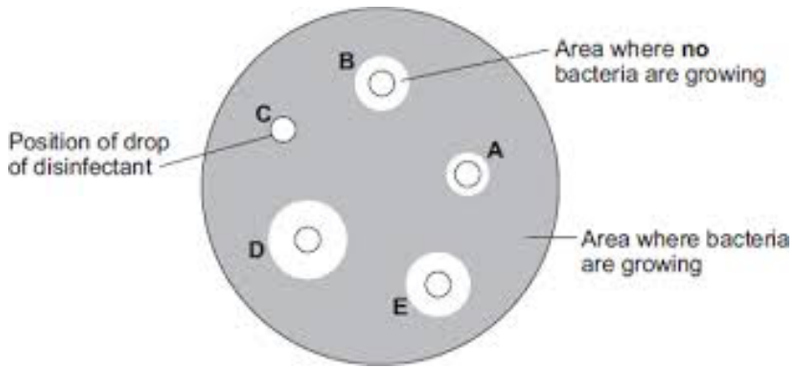
The water moves **from a high concentration** (inside the potato) **to a low concentration** (inside the solution) through a **partially permeable membrane.**

If a potato is placed in a **low sugar or salt concentration** solution, it will **gain mass** as it loses water through osmosis.

This is because **there is less water in the potato chip** compared to the solution.

The water moves **from a high concentration** (inside the solution) **to a low concentration** (inside the potato) through a **partially permeable membrane.**

Culturing Micro-organisms



Variables

Independent variable (the thing that you change) – the type of antibiotic

Dependent variable (the thing that you measure) – the area that the bacteria did not grow

Control variables (the things that you keep the same)
- Temperature
- Time
- Size of disc
- Species of bacteria

We **dry the potato chips** before weighing them to **remove any excess water** that could affect the results.

We measure **percentage change in mass** instead of just change in mass.

This is because all the potatoes have **different starting masses** and so gives us a valid comparison.

Zone of inhibition = Full area where it did not grow - area of disc

Area of a circle = πr^2

Keeping a sterile environment

- **Use a Bunsen Burner – t**his kills any surrounding bacteria
- **Keep the lid on** unless absolutely necessary – this prevents any surrounding bacteria contaminating the agar
- **Store at 25°C** to prevent the growth of harmful pathogens
- **Disinfect surfaces before and after use** to prevent contamination of the sample and to maintain a sterile environment

The bacteria is grown on **agar gel** to provide nutrients (e.g. carbohydrates) for the bacteria