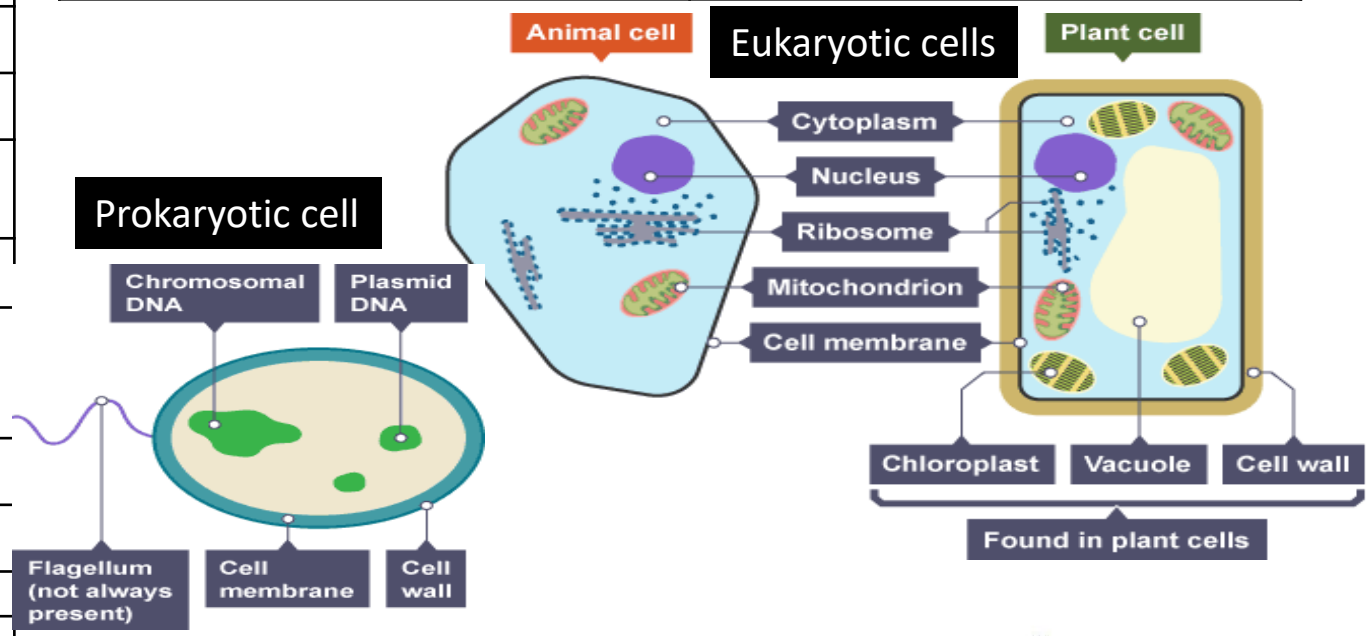
Cell Biology

Section 1- Cell Structure

Structure	Function	Eukaryotic Cells: Animal Cells	Eukaryotic Cells: Plant Cells	Prokaryotic Cells: Bacterial Cells
1. Nucleus	Contains the **genetic information** that controls the functions of the cell.	Y	Y	
2. Cell Membrane	Controls what substances **enter & leave** the cell.	Y	Y	Y
3 Cytoplasm	Where many cell activities & chemical **reactions** happen.	Y	Y	Y
4 Mitochondria	Where energy is released from glucose (using oxygen) in a process called **aerobic respiration.**	Y	Y	
5 Ribosomes	Make proteins- site of **protein synthesis**.	Y	Y	Y
6 Chloroplast	Contains chlorophyll that traps sunlight. This is where **photosynthesis** occurs. CO_2 and H_2O are converted to glucose ($C_6H_{12}O_6$) and O_2 in this process.		Y	
7 Vacuole	Use to store water & other chemicals as **cell sap.**		Y	
8 Cell Wall	**Strengthens & supports** the cell (made of cellulose in plants)		Y	Y
9 Flagella	A whip-like structure that allows movement			Y
10 Plasmid	A **small circle of DNA** that can be transferred between bacterial cells. They may contain genes associated with antibiotic resistance.			Y

Section 2-Types of cell

11 **Prokaryotic cells** are very primitive cells e.g. bacteria. These cells have not evolved to have internal membranes. They do not have their genetic material bound by a nucleus.	12 **Eukaryotic cells** are more evolved and have internal membranes e.g. a nucleus, mitochondria. Examples include plant and animal cells.



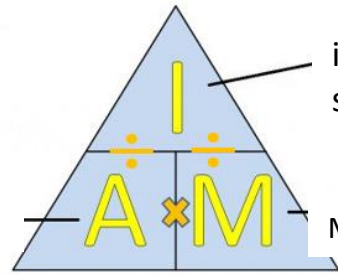
Section 3- Microscopy

13 Magnification	Tells you how many times bigger a microscope makes an object. **Magnification = length of magnified image÷ length of actual object**
14 Resolution	The ability of a microscope to distinguish between 2 separate points. Allows finer detail to be observed.
15 Light Microscope	A basic microscope, using light. Can magnify objects ×1500
16 Electron Microscope	A microscope which uses electrons that are fired at a specimen and scattered back, forming an image. It is used to magnify images more than a light microscope. Gives greater detail. Can magnify objects × 2,000,000

5/200 = 0.025 mm
0.025 mm x 1000 = **25µm**

Section 4- Orders of Magnitude

Unit Prefix	Size in Metres	
Centimetre (cm)	0.01m	100 cm= 1m
Millimetre (mm)	0.001m	1000 mm= 1m
Micrometre (µm)	0.000001m	1000000 µm = 1m
Nanometre (nm)	0.000000001m	1000000000 nm = 1m



Section 5- converting units

Unit conversion	What to do
cm >mm	x 10
mm > cm	/ 10
mm > µm	x 1000
µm > mm	/ 1000

Question: You are looking at a plant cell under a microscope. The cells on the slide appear to measure 5 mm in length with a magnification of x200 on the light microscope.

What is the actual size of the cell in micrometres (µm)?

(The answer is displayed on the bottom of this sheet in small font for you to check your answer against!)

Section 6- Specialised Cells

Animal and plant cells can be specialised to carry out particular roles.

Specialised Cell	How structure relates to function
17 Sperm Cell	**Acrosome** (sac-like structure) in the head of the sperm contains **enzymes** to break the egg's cell membrane Has a **tail** to swim. **Many mitochondria** at the base of the tail to provide **energy from respiration** so the tail can move. The nucleus contains **half the DNA** to ensure a full set of DNA is achieved during fertilisation.
18 Nerve Cell	**Long structure** called an **axon** to transmit electrical impulses across a long distance. The axon is **insulated** with fat to **speed up the transmission** of the electrical signal across the nerve cell. **Branch-like ending** on the cell body that allow nerve cells to **communicate** with each other.
19 Red blood cell	**No nucleus** so that these cells can carry more of a pigment called **haemoglobin**. Haemoglobin **binds oxygen** and transports it around the body. **Biconcave** shape to **increase** the **surface area** of the cell, thus increasing the speed of **diffusion of oxygen** into the cell.
20 White blood cell	**Branched nucleus** so it can be squashed to the back of the cells when the cell is engulfing a foreign body, such as a bacterial cell. Cytoplasm high in **enzymes** that can break down a bacterial cell.
21 Muscle Cell	Contain **protein fibres** that contract when energy from respiration is available, making the cells shorter. This shortening of the cells brings about **movement** (usually of bones but sometimes the contents of an organ e.g. the stomach).
22 Root Hair Cell	**Long extension** (root hair) to provide a **large surface area** for water & mineral absorption. Thin cell wall to increase the speed of **diffusion/osmosis**.
23 Xylem Cell	**Waterproofed cell wall** (chemical called lignin) to keep water inside. The cells are **dead and hollow** to allow water through, like a drinking straw.
24 Phloem Cell	Some of these cells have **a lot of mitochondria** to provide energy from respiration for **active transport** so that sugars can be transported in any direction around the plant. Some of these cells have l**ittle cytoplasm** and **sieve-like ends** for sugars to move through easily.
25 Palisade cells	**Square-like** shape so they can connect with others palisade cells to form the **continuous flat surface** of the leaf in a plant. The cells contain **many chloroplasts** to trap the **light energy** shining through the leaf and perform **photosynthesis** at a high rate.

Section 7- Name that specialised cell

Decide if each specialised cell is plant or animal and what its name is. (Answers are on the right)

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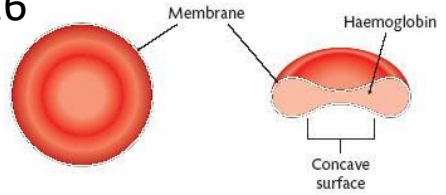

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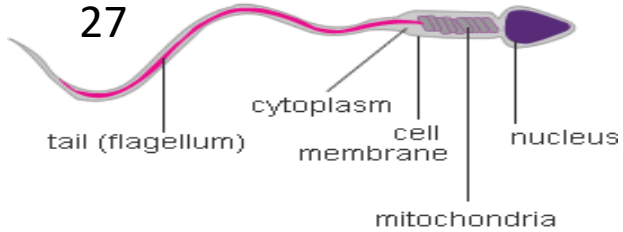

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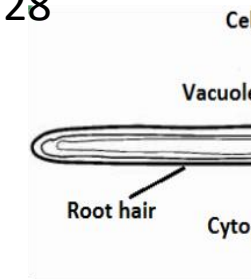

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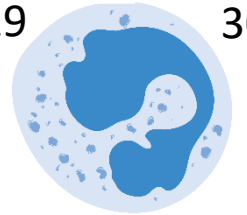

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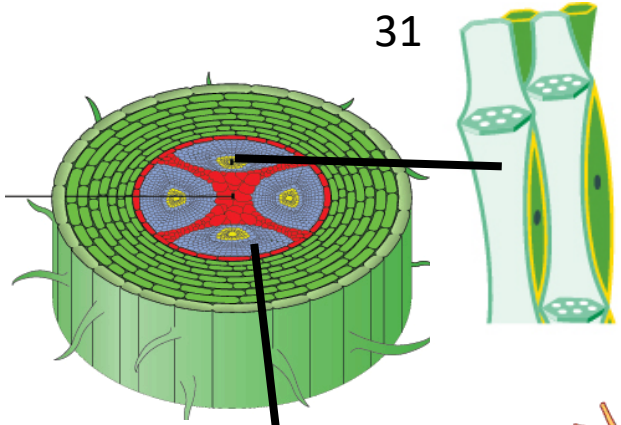

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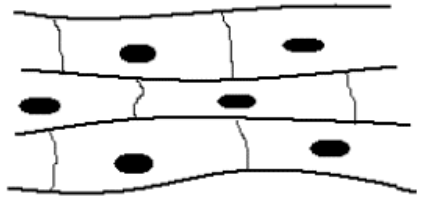

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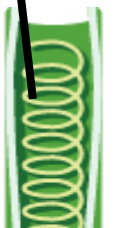

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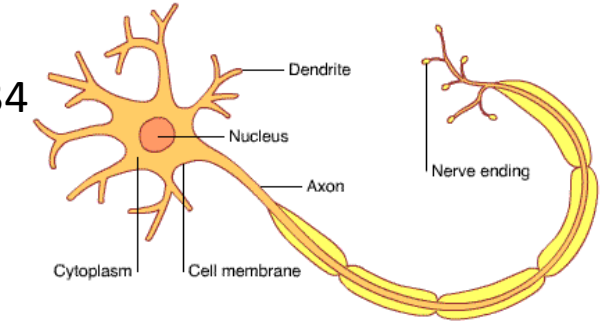
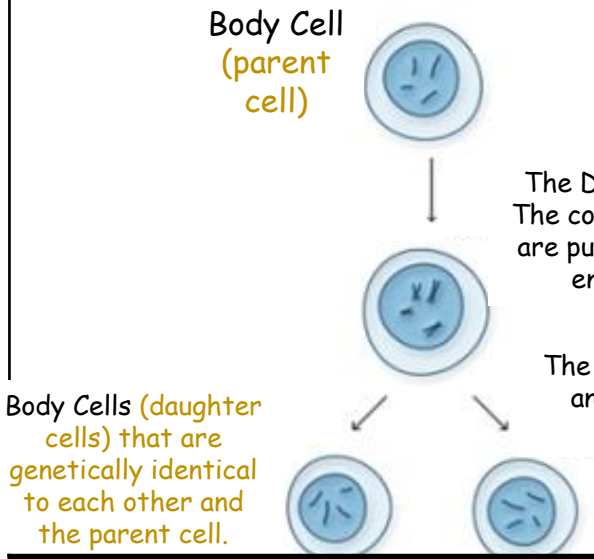


26. Red blood cell 27. sperm cell 28. Root hair cell 29 White blood cell 30 palisade cell 31. Phloem cell 32. Xylem cell 33. Muscle cell 34. Nerve cell (neurone)

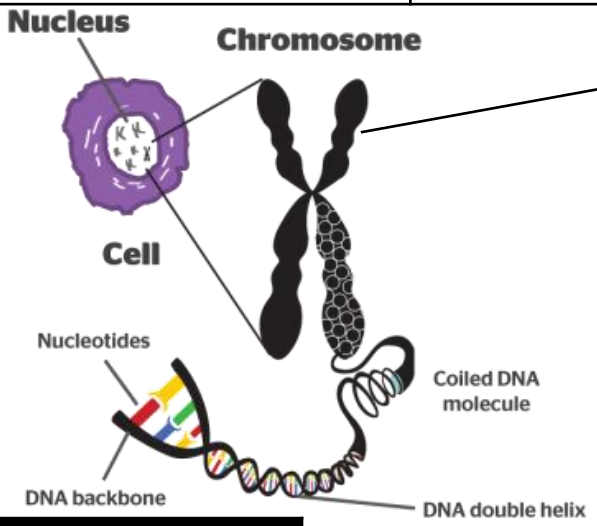
Section 9: Mitosis

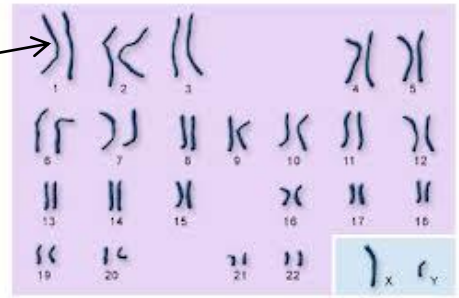
Definition	When it occurs
37 Mitosis is the process of making an identical copy of a body cell, where all chromosomes need to be copied.	**38 Growth:** when more identical body cells are needed to increase the size of an organism e.g. fertilised egg cell> embryo > foetus > child > adult **39 Repair**: to replace damaged cells in the body **40 Replacement**: when old cells nearing the end of their life are replaced by new ones e.g. red blood cells.



Section 8: Genetic material (prior learning)

35 Genetic material, called DNA ,is found inside the nucleus of a eukaryotic cell. It is found coiled up to form structures called **chromosomes**.	36 Chromosomes contain a large number of genes that code for feature in the body by coding for proteins. Chromosomes are usually found in pairs, with one of each pair coming from each parent..



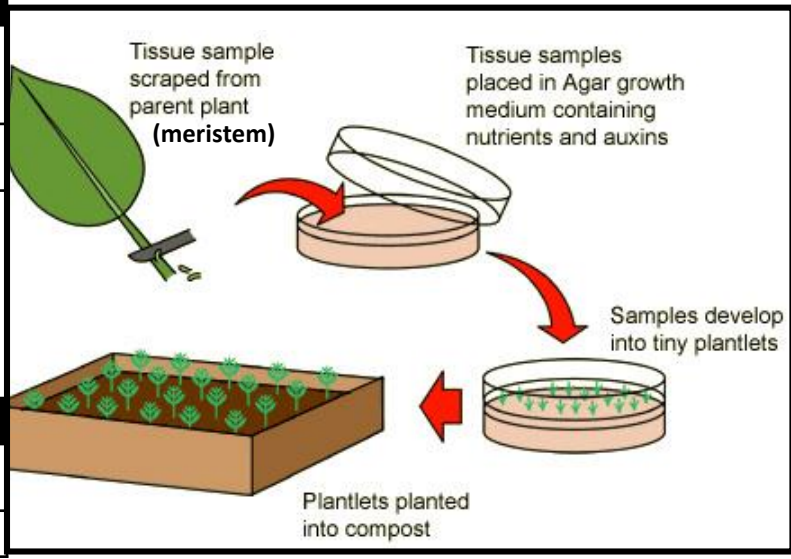


23 chromosome pairs in a human cell.

Section 10: Stem Cells

Stem Cell	Properties	Uses
41 Embryonic stem cell	Can divide into **most types** of cell.	**Therapeutic cloning** – embryonic stem cells produced with the same genes as the patient. In the future entire organs could be grown and transplanted into the patient. There is no risk of **rejection**.
42 Adult stem cell	Can divide into a **limited number of cells** e.g. bone marrow stem cells can form various blood cells.	Skin grafts, replacement bone marrow following chemotherapy..
43 Meristem	Found in plants. Can differentiate (divide) into **any type** of plant cell. This can happen at any time throughout the plants life Meristems can produce plant clones quickly and economically by taking cuttings or tissue culture (see diagram on the right).	**Clone** rare species to **prevent extinction**. **Crops** with **special features** can be cloned so more desirable crops are obtained.

Pros and Cons of Using Stem Cells	
44 Pros	**Treatment of diseases** such as diabetes, dementia and paralysis. In the future therapeutic cloning could be used to produce entire organs for patients with no risk of rejection.
45 Cons	**There are ethical** and **religious** objections. Can **transfer viruses** held within cells.



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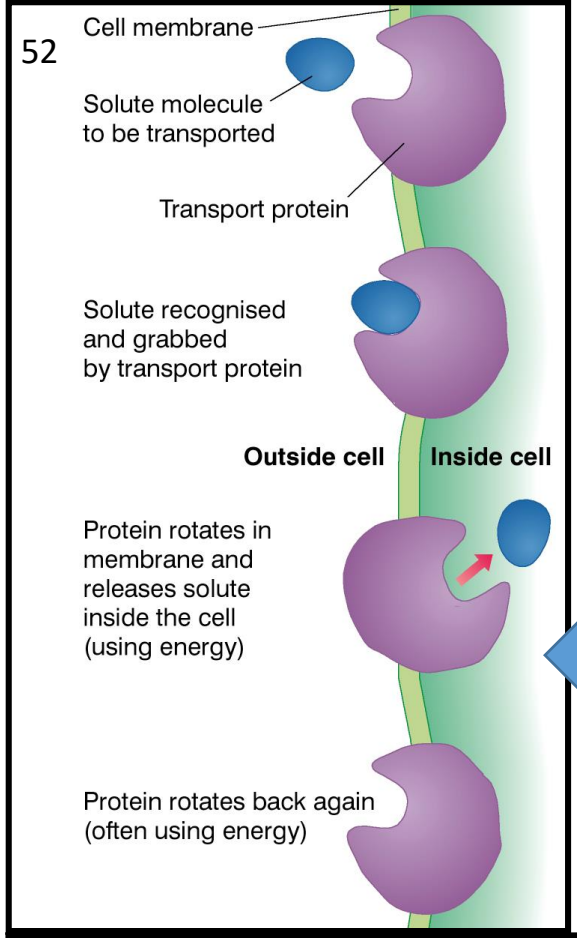
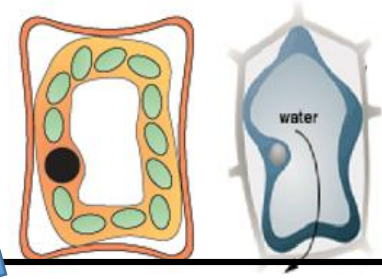


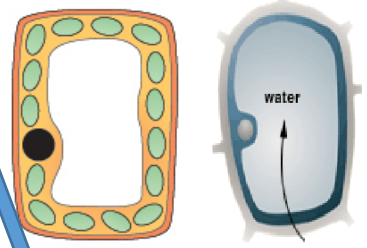
Section 11: Transport Across Membranes

Cell Structure	Definition	Uses
46 Diffusion	**Spreading** out of the particles (gas/ solution) resulting in a **net movement** from an area of **higher concentration** to an area of **lower concentration.** It is a **passive process.** This means energy is not needed.	**Oxygen** and **carbon dioxide** in **gas exchange** (leaves and alveoli). **Urea** from **cells** into the **blood plasma** for excretion in the kidney.
47 Osmosis	The diffusion of water from a dilute solution to a concentrated solution through a partially permeable membrane. It is a **passive process.** This means energy is not needed.	Movement of water into and out of cells.
51 Active Transport	The movement of substances from a more dilute solution to a more concentrated solution (against a concentration gradient). **Requires energy** from respiration as so is an 'active' process.. Requires a **transport protein** in the cell membrane.	**Absorption** of **mineral ions** (low concentration) from soil into **plant roots**. **Absorption** of **sugar molecules** from lower concentrations in the **gut** into the **blood** which has a higher sugar concentration.

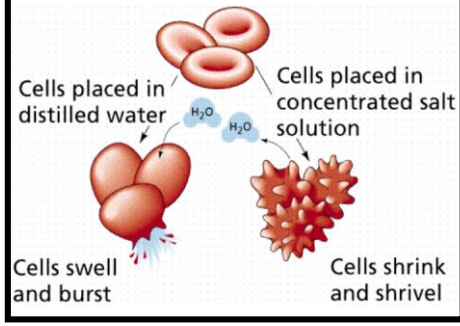
48 Water passes out of dehydrated plant cells and they become flaccid (floppy). This can be seen as the stem of a plant wilts.



49 Water passes out into plant cells by osmosis, pushing the cell wall out, making them swell. We say the cells are turgid.



50 Water levels in the blood need to be controlled as the cells can shrivel or burst as a result of osmosis



Section 12: Factors Affecting Diffusion

Factor	Explanation
53 Difference in concentrations (**concentration gradient**)	The greater the difference in concentrations, the faster the rate of diffusion.
54 **Temperature**	Particles move more quickly at higher temperatures, so rate of diffusion increases.
55 **Surface area** of membrane	The greater the surface area the quicker the rate of diffusion.

Section 13: Adaptations of Exchange Surfaces for diffusion

56	**Large surface area**
57	**Thin membrane** to provide a **short diffusion path**
58	**Ventilation** (in animals for gas exchange – maintains a concentration gradient)
59	**Efficient blood supply** (in animals – maintains a concentration gradient)

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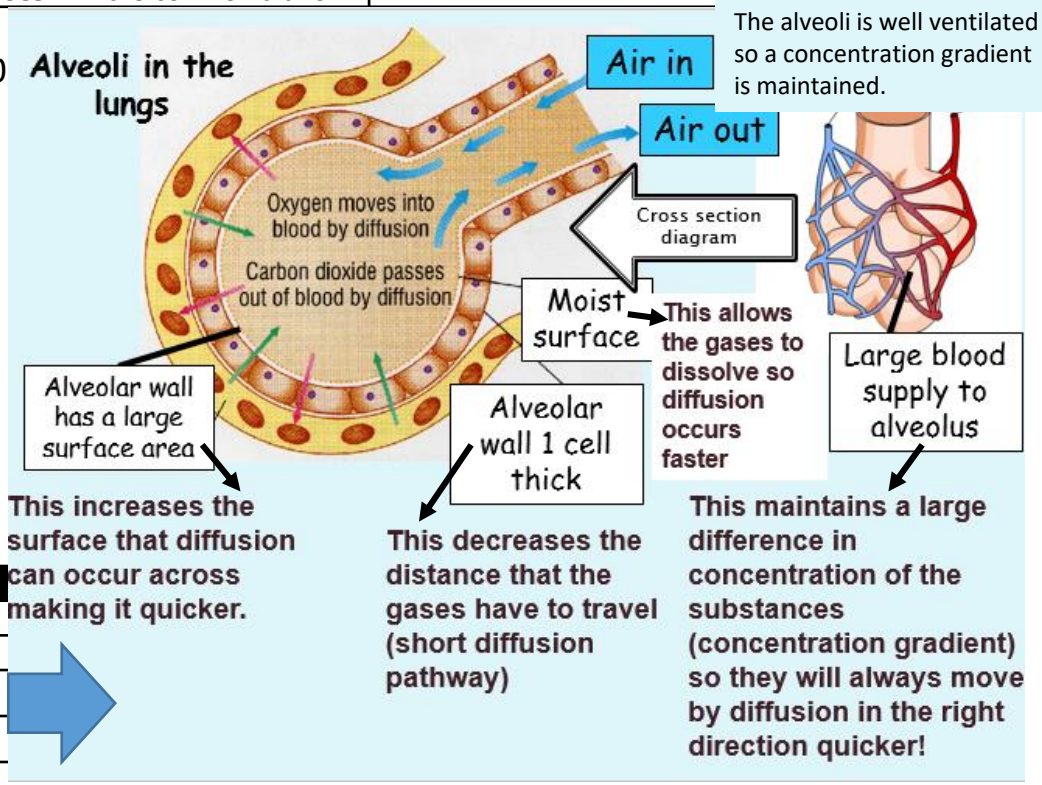

The alveoli is well ventilated so a concentration gradient is maintained.