MOVEMENT IN AND OUT OF CELLS

3.1 Diffusion

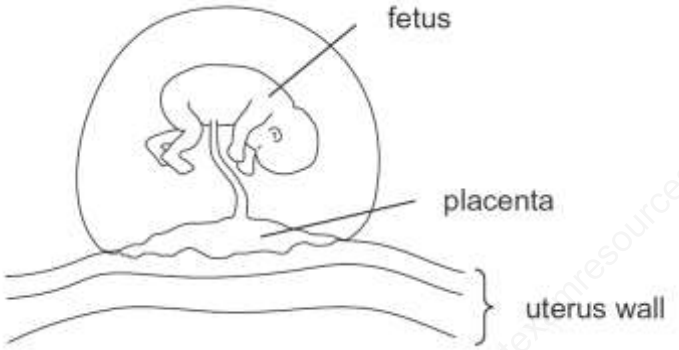
- **Diffusion** as the net movement of particles from a region of their higher concentration to a region of their lower concentration down a concentration gradient as a result of their random movement.
- Substances move into and out of cells by diffusion through the cell membrane
- The energy for diffusion comes from the kinetic energy of random movement of molecules and ions.

The importance of diffusion of gases and solutes:

- Cells gain some of the substances they need by diffusion from their surroundings.
- They also lose some of their waste substances to their surroundings by diffusion. Some of the substances that diffuse in and out of cells are: oxygen, carbon dioxide and water. Larger molecules cannot pass through.

Some of the uses of diffusion are state below:

1.



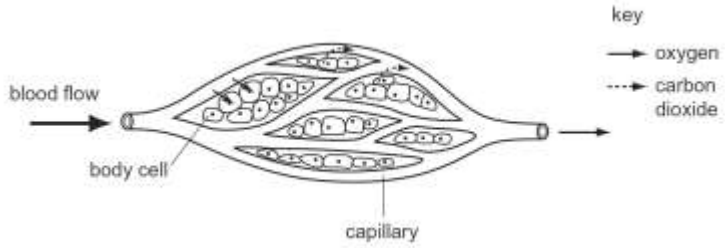
Substances pass via the placenta and uterus wall via diffusion

---

2.On a dry, sunny day, water vapour moves through the stomata of a leaf via diffusion.

---

3. The movement of oxygen and carbon dioxide between body cells and the blood in capillaries is through diffusion.



4.Factors that affect diffusion

These factors influence the efficiency of diffusion.

- **The distance molecules have to travel** – note that cell membranes are very thin.
- **The concentration gradient** – cells use the substances that diffuse in as quickly as possible, so they keep a low concentration inside the cytoplasm. This means that the molecules keep diffusing into the cell because the cell is maintaining a steep concentration gradient.
- **The surface area** – some cells have cell membranes that are folded to give a large surface to allow many molecules to cross by diffusion.
- **The temperature** – molecules move faster and collide more often as the temperature increases. Diffusion is faster at warmer temperatures.
- The size of molecules – small molecules diffuse faster than large ones.

Note: As per syllabus only 4 factors are needed, namely: **The distance molecules have to travel, The concentration gradient, The surface area and the temperature.**

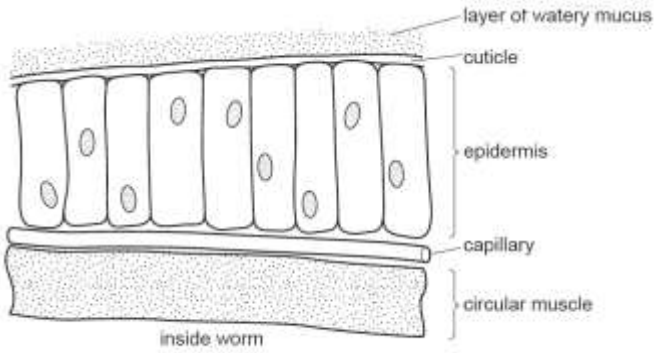
Gas exchange in mammals:

- It is performed at the alveoli in the lungs.
- Blood transports these two gases between the lungs and all the cells in the body.
- In the alveoli, oxygen diffuses across a very thin layer of cells into the blood.
- Carbon dioxide diffuses in the opposite direction. Breathing constantly refreshes the air in the alveoli and blood constantly removes oxygen and brings carbon dioxide, so the concentration gradients are always steep.
- There are many alveoli to give a very large surface area for gas exchange.

Gas exchange in plants:

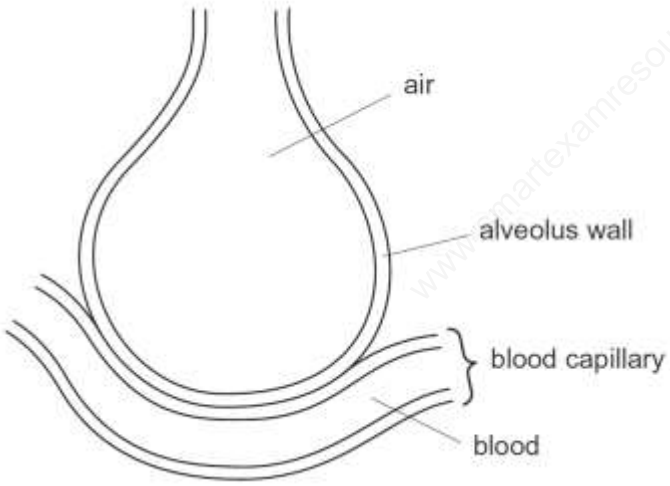
- In plants, gas exchange occurs inside the leaves.
- The spongy mesophyll cells provide a large surface area for exchange of gases.
- There are air spaces between the cells in a plant and each cell exchanges gases with this air.

The following is a section through the skin of an earthworm. The skin acts as the earthworm's gaseous exchange surface.



The features, which make this surface well adapted for gaseous exchange are as below:

- This surface is one cell thick
- Capillary is close to the epidermis.
- Gases dissolve in the layer of mucus



The diagram shows a gaseous exchange surface (alveolus) and part of a nearby capillary. The rate of absorption of oxygen into the capillary could be increased by increasing the surface area of the alveolus.

- A **solution** is made up of two parts, the **solute** and the **solvent**.