

These notes explain the **why** behind every concept, not just the what. They include **analogies**, **real-life examples**, and explanations of **common mistakes**. Use these alongside your revision notes for full understanding.

## Topic 1 Key Concepts — The Foundations of Biology

The concepts in Topic 1 appear throughout all other topics. A solid understanding of cells, enzymes, and transport mechanisms will make every other biology topic easier to understand.

### The Cell — A Masterpiece of Molecular Engineering

A cell is not a simple bag of chemicals — it is a highly organised, dynamic system. Every structure has a purpose shaped by billions of years of evolution. The cell membrane is not just a container — it is an active surface that controls the cell's environment with extraordinary precision.

■ **Think of it like this:** *The cell membrane is like a bouncer at a nightclub. Some things are welcomed in (glucose, oxygen), some are let out (CO<sub>2</sub>, waste), and some are actively escorted in even when they do not want to come (minerals by active transport). The bouncer (membrane) decides who gets in, not the crowd outside.*

### Enzymes — Why Life Requires Catalysts

Without enzymes, most biochemical reactions would proceed far too slowly to support life. For example, the conversion of CO<sub>2</sub> to carbonic acid in blood (important for CO<sub>2</sub> transport) would take 15 seconds without a catalyst. With the enzyme carbonic anhydrase, it takes 0.0001 seconds — 150,000 times faster.

■ **Why does this happen?** Why does denaturation kill an organism? Every chemical reaction in the body is controlled by enzymes. If enzymes denature (above about 40°C in humans), reactions stop. Proteins cannot be digested, glucose cannot be broken down for energy, DNA cannot be replicated. A sustained body temperature of 42°C is life-threatening for exactly this reason.

<b>Organelle</b>	A specialised structure within a cell with a specific function
<b>Selectively permeable</b>	Allowing some substances through but not others — describes the cell membrane
<b>Enzyme</b>	A protein biological catalyst — speeds up reactions without being consumed
<b>Substrate</b>	The molecule an enzyme acts on — fits into the active site
<b>Induced fit model</b>	The active site changes shape slightly to fit the substrate — more accurate than the rigid lock and key model