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.

4.7.1 Ecosystems — Everything is Connected

An ecosystem is not just a collection of organisms — it is a complex web of interactions between organisms and between organisms and their non-living environment. Change one part of an ecosystem and you trigger a cascade of effects throughout the whole system.

■ ***Think of it like this:*** *An ecosystem is like a carefully balanced mobile hanging from a ceiling. Pull on one piece — even a small one — and everything else shifts. Remove a piece entirely and the whole structure becomes unbalanced.*

Abiotic and Biotic Factors

Abiotic factors are the non-living physical and chemical conditions of an environment: temperature, light intensity, water availability, soil pH, wind speed, oxygen concentration. Biotic factors are the living components: food availability, predators, competitors, disease organisms, mutualistic partners.

■ **Real-life example:** When rabbits were introduced to Australia in 1859, they had no natural predators. Their population exploded, destroying vegetation and causing soil erosion. This shows how removing a biotic factor (predation) can devastate an entire ecosystem.

4.7.2 Energy Flow and Material Cycles

Why Only 10% of Energy Transfers to the Next Level

Energy enters ecosystems as sunlight, captured by producers. As energy passes along a food chain, most of it is lost at each step. This is why food chains rarely have more than five links.

■ **Why does this happen?** Where does the "lost" energy go? Organisms use energy for movement, maintaining body temperature, growth and reproduction. Some energy passes out as waste (urine, faeces) and is not available to the next consumer. Heat is also lost during every metabolic reaction — this energy cannot be recaptured. Only the energy stored in biomass (new cell growth) is available to the next organism that eats it.

- On average, only about 10% of energy from one trophic level is transferred to the next.
- This is why it takes far more land to feed a meat-eating population than a plant-eating one — cattle must eat roughly 10 kg of plant material to produce 1 kg of meat.

The Carbon Cycle — Carbon Never Disappears, It Just Moves

Carbon is the foundation of all organic molecules — carbohydrates, proteins, lipids, DNA. The same carbon atoms have been cycling through living organisms and the environment for billions of years.

Step 1	**Photosynthesis**	Plants remove CO■ from the atmosphere and fix it into organic molecules (glucose). This is the only process that removes carbon from the atmosphere.
Step 2	**Feeding**	Animals eat plants and incorporate the carbon into their own molecules.
Step 3	**Respiration**	All living organisms respire, releasing CO■ back into the atmosphere.
Step 4	**Death and decomposition**	When organisms die, decomposers (bacteria and fungi) break down organic molecules, respiring and releasing CO■.
Step 5	**Combustion**	Burning wood or fossil fuels rapidly releases carbon that has been stored for millions of years.

"Trees absorb CO■ permanently."

✓ **Actually:** release the fossil fuels i reintroducin

Biodiversity — Why Variety Matters

Biodiversity refers to the variety of life — the number of different species in an area, the variety within each species, and the variety of ecosystems. High biodiversity makes ecosystems more stable and resilient. When one species is lost, others can partially fill its role.

Human activities are causing what scientists call the sixth mass extinction — a rapid loss of species due to habitat destruction, climate change, pollution, invasive species, and overexploitation. The rate of extinction today is estimated to be 100 to 1000 times higher than the natural background rate.

■ **Real-life example:** Bees are essential pollinators for many food crops. Colony collapse disorder — where bee populations suddenly die — has farmers extremely worried. No bees = no pollination = no fruits, nuts or seeds for many crops. The economic and food security consequences would be enormous.

Ecosystem	A community of organisms plus the non-living environment they interact with
Biotic factor	A living component affecting an organism's survival — e.g. predators, food availability, disease
Abiotic factor	A non-living component affecting organisms — e.g. temperature, light, rainfall
Trophic level	A feeding level in a food chain — producers are level 1, primary consumers level 2, etc.
Decomposer	Organism (bacteria or fungi) that breaks down dead organic material, releasing minerals and CO■
Carbon cycle	The movement of carbon through the atmosphere, living organisms, soil and oceans
Biodiversity	The variety of species, genes and ecosystems in a given area
Deforestation	Permanent removal of trees from an area — reduces biodiversity, releases stored CO■, causes soil erosion