B6: Life on Earth

OCR Gateway · GCSE Biology · Revision Notes

Specification reference: B6a–B6c

Note: Sections marked ★ HIGHER TIER ONLY are for Higher tier students only. Foundation tier students should focus on the unmarked sections.

B6a Origins of Life and Early Earth

Life on Earth began approximately 3.5 billion years ago. The Miller-Urey experiment showed that organic molecules (amino acids) can form from simpler molecules given an energy source, suggesting how life may have originated.

- The fossil record provides evidence of how life has changed over time.
- Older fossils are found in deeper rock layers.
- Gaps in the fossil record exist because soft bodies do not fossilise easily.

B6b Natural Selection, Selective Breeding and Genetic Engineering

Humans have used selective breeding for thousands of years to improve crops and animals.

- Selective breeding: choose individuals with desired characteristics → breed them → select best offspring → repeat.
- Examples: increased crop yield, disease resistance, docile temperament in animals, high milk production in cows.
- Risk: reduces genetic diversity (gene pool narrows), making the population vulnerable to new diseases.

Genetic engineering: a gene for a useful characteristic is cut from one organism's DNA and inserted into another organism's genome.

- Restriction enzymes cut out the gene.
- The gene is inserted into a plasmid (vector).
- The plasmid is introduced into the host cell.
- Example: human insulin gene inserted into bacteria → bacteria produce insulin.
- GM crops: herbicide-resistant crops, golden rice (with extra vitamin A gene).

★ HIGHER TIER ONLY — Cloning

- Tissue culture: small number of cells from a plant are grown in sterile nutrient solution to produce many genetically identical plants.
- Embryo splitting: early embryo is divided into separate cells, each grown into a complete organism.
- Adult cell cloning: nucleus from adult cell placed into enucleated egg → embryo implanted into surrogate mother. Example: Dolly the sheep.
- Issues: ethical concerns, reduced genetic diversity, animals may age prematurely.

B6c Extinction and Biodiversity

Species extinction occurs when the last individual of a species dies. Extinction rates are increasing due to human activity.

- Causes of extinction: habitat destruction, hunting, climate change, invasive species, disease, pollution.
- Conservation methods: nature reserves, breeding programmes, seed banks, international agreements, sustainable farming.
- Importance of biodiversity: ecosystems are more resilient; source of food, medicines and materials; ethical reasons.

Human impacts on ecosystems: deforestation (CO_2 release, habitat loss), pollution (acid rain, eutrophication), global warming (rising temperatures, sea level rise, species migration).

Exam Tip: Eutrophication: excess fertilisers run into water → algal bloom → blocks sunlight → plants die → bacteria decompose them → bacteria use O_2 → fish suffocate.