

B6 Inheritance, variation and evolution

Biology Paper 2 | AQA Combined Science Trilogy | Key ideas to remember

Genes and inheritance

1 DNA and reproduction

DNA: two-stranded polymer, double helix. A chromosome contains DNA; a **gene** is a section coding for an amino acid sequence in a protein.
Genome: all genetic material.

Sexual: gametes fuse; information mixes.
Asexual: one parent, no gamete fusion; mitosis makes genetically identical clones.

Meiosis: DNA copied, then two divisions → four genetically different gametes with half the chromosome number.

Fertilisation: $23 + 23 \rightarrow 46$ in humans.
Embryo grows by mitosis; cells differentiate.

Genomes help study disease, inherited conditions and past human migration.

Variation and selection

2 Alleles and genetic crosses

Allele: version of a gene. **Genotype:** alleles present. **Phenotype:** expressed characteristic. AA / aa: homozygous; Aa: heterozygous. A dominant allele is expressed in AA and Aa; recessive in aa.

	A	a
A	AA	Aa
a	Aa	aa

Aa × Aa

Dominant : recessive = 3 : 1

P(aa) = $\frac{1}{4}$ = 25%

Each offspring is a new chance.

Cystic fibrosis: recessive; Ff is a carrier, ff affected. **Polydactyly:** dominant.
Sex: XX × XY gives $\frac{1}{2}$ XX and $\frac{1}{2}$ XY in the usual model.

HT: construct crosses from descriptions.

Evidence for evolution

3 Variation and natural selection

Variation can be **genetic, environmental or both**. Mutations create new variants; most do not affect phenotype. Mutations do not arise because they are needed.

Inherited variation

↓
Better suited survive

↓
Survivors reproduce

↓
Useful alleles more common

Evolution: inherited population traits change over generations. Different species cannot interbreed to produce fertile offspring.

4 Selecting and engineering genes

Selective breeding: choose parents → breed → select offspring → repeat over generations. Select yield, disease resistance or appearance.
Inbreeding increases inherited-problem risks.

Genetic engineering: introduce another organism's gene for a desired trait. Examples: insect-resistant crops; insulin-producing bacteria.
Evaluate benefits and specific risks.

HIGHER ONLY: enzyme isolates gene → insert into plasmid / virus vector → transfer into target cells, often early in development.

Embryo screening: information about tested inherited conditions; consider reliability, cost, access and ethical views.

5 Fossils, extinction and resistance

Fossils: preserved remains, mineral replacements or traces. The record has gaps: soft bodies decay; geological change destroys evidence.

Extinction: no individuals remain. Causes include environmental change, predators, disease and competition.

Antibiotic resistance: random mutation → resistant bacteria survive treatment → reproduce and pass on resistance. Resistance becomes more common. Antibiotics select existing variants.

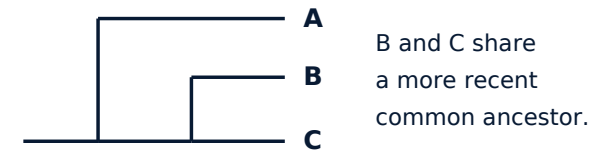
Avoid unnecessary antibiotics; take them as prescribed. Hygiene reduces spread.

6 Classification and tree evidence

Linnaeus: kingdom → phylum → class → order → family → genus → species.

Binomial: genus + species, e.g. *Panthera leo* (capital P; lower-case l).

Woese's domains: Archaea, Bacteria, Eukaryota. Animals, plants, fungi and protists are Eukaryota. Molecular evidence can change classification.



Trees show ancestry. Compare DNA and fossils.