6.4 Evolution, genetics and evidence

Name: _____ Class: _____ Date: _____ **Total: 22 marks**

KEY WORDS fossil • speciation • antibiotic resistance

Objective

Tell the history of evolution and genetics, explain fossils, extinction and antibiotic resistance. Biology only. Original questions for spec statements 4.6.3.

1 Key knowledge and worked examples

Darwin: after a round-the-world expedition, experiments and discussion, proposed **evolution by natural selection** – variation within a species; the best-suited survive and breed; their characteristics are passed on. Published *On the Origin of Species* (1859). Accepted only gradually because:

- it challenged the idea that God made all animals and plants;
- there was **insufficient evidence** at publication;
- the **mechanism of inheritance was unknown** until 50 years later.

Lamarck – changes acquired during an organism's lifetime are inherited – now known wrong in almost all cases.

Wallace: independently proposed the theory; **joint 1858 publications** with Darwin prompted Darwin to publish; best known for **warning colouration** and pioneering **speciation**.

Mendel: mid-19th-century pea breeding – each characteristic inherited through 'units' passed on unchanged; importance unrecognised in his lifetime. Then: chromosomes observed (late 19th c.) → 'units' behave like chromosomes → **genes on chromosomes** (early 20th c.) → **DNA structure and gene function** (mid 20th c.).

Evidence for evolution: characteristics passed on in genes; **fossils**; **antibiotic resistance** in bacteria.

Fossils form: (1) parts **not decayed** – a decay condition absent; (2) parts **replaced by minerals** as they decay; (3) **preserved traces** – footprints, burrows, rootlet traces. Early soft-bodied life left few traces, mostly destroyed by **geological activity** – so how life began is uncertain. Fossils show how much or little organisms have changed; **evolutionary trees** combine classification and fossil data.

Extinction – no individuals of a species remain: new diseases, new predators, new competitors, environmental change, catastrophic events.

Resistant bacteria: bacteria reproduce fast → **mutations** produce new strains; a resistant strain survives antibiotics, reproduces and spreads (people are not immune; no effective treatment) – MRSA. Reduce the rate: doctors avoid **inappropriate prescribing** (non-serious/viral infections); patients **complete the course**; restrict **agricultural use**. New antibiotics are costly and slow, unlikely to keep pace.

Worked example (4 marks). Explain why patients must complete a course of antibiotics.

Stopping early leaves bacteria alive; the survivors may include mutants with partial resistance; these reproduce, forming a resistant strain; completing the course kills all the bacteria, leaving none to mutate and multiply.

2 Practice

2.1 Give two reasons Darwin's theory was accepted only gradually. [2]

2.2 What was Mendel's key observation, and what do we now call his 'units'? [2]

2.3 Give the three ways fossils form. [3]

3 Exam-style questions

3.1 Explain how fossils provide evidence for evolution, and why scientists cannot be certain how life on Earth began. [5]

3.2 Explain how a strain of MRSA becomes resistant and spreads, and give three measures that slow resistance. [6]

3.3 Describe how Wallace's work relates to Darwin's, and one reason joint publication mattered. [4]