

Darwin, natural selection and antibiotic resistance: practice questions

6 questions • 19 marks • mark scheme at the back

For Edexcel GCSE Biology 1BI0 and Combined Science 1SC0. **Triple only** is not in Combined Science. **Higher tier** is only on the Higher paper.

Name

Total / 19

1 Which statement describes how natural selection leads to evolution? [1 mark]

- A. ☐ Individuals change their characteristics to suit the environment during their lives.
- B. ☐ Individuals with advantageous alleles are more likely to survive and reproduce, so the alleles become more common.
- C. ☐ The strongest individuals always live longest and produce the most offspring.
- D. ☐ Mutations only happen when the environment changes.

2 **Triple only** [2 marks]

Describe the contribution of Alfred Wallace to the theory of evolution by natural selection.

3 **Triple only** [3 marks]

Explain the impact of the ideas of Darwin and Wallace on modern biology.

- 4** A population of beetles lives on pale sand. Most beetles are pale. A mutation produces a few dark beetles. Birds eat the beetles. After many generations, most beetles on the sand are pale and very few are dark. Explain how natural selection causes this. **[4 marks]**

[illegible]

- 5** In a practice data set, 250 samples of bacteria were tested. In year 1, 20 samples were resistant to an antibiotic. In year 5, 85 samples were resistant. Calculate the percentage of resistant samples in each year and the increase in percentage points. **[3 marks]**

Answer =

[illegible]

- 6** Explain how antibiotic-resistant bacteria emerge in a population of bacteria, and how this supports Darwin's theory of evolution by natural selection. **[6 marks]**

[illegible]

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

B B (1)

2. [2] Triple only

- he independently developed a theory of evolution by natural selection (1)
- his ideas were based on his own observations of plants and animals in different places (1)
- his work encouraged Darwin to publish / ideas presented together with Darwin's (1)
- Max 2

3. [3] Triple only

- gives a unifying explanation of the diversity of living things / how species are related (1)
- when combined with genetics, explains variation (from mutation) and inheritance (1)
- helps explain the emergence of resistant organisms, for example antibiotic-resistant bacteria (1)
- allows organisms to be classified by how they are related (1)
- Max 3

4. [4]

- variation / dark beetles are more visible (to birds) than pale beetles (1)
- dark beetles are more likely to be eaten / pale beetles are more likely to survive (1)
- pale beetles reproduce more / have more offspring (1)
- they pass on the allele for pale colour (1)
- proportion of pale beetles increases over generations (1)
- Max 4

5. [3]

- year 1: $20 \div 250 \times 100 = 8\%$ (1)
- year 5: $85 \div 250 \times 100 = 34\%$ (1)
- increase = 26 percentage points (1)
- allow ecf for the final mark

6. [6]

Level 3 5-6	A detailed and coherent explanation which covers the sequence from mutation to a resistant population, with the antibiotic identified as the selection pressure, and links this clearly to Darwin's theory.
Level 2 3-4	A partly detailed explanation that covers most of the sequence, with some links to Darwin's theory. There may be some gaps in the logic.
Level 1 1-2	A basic explanation with one or two relevant points, but little or no link to natural selection.

Indicative content

- variation in the population: a mutation gives some bacteria an allele for resistance
- antibiotic kills the non-resistant bacteria / is the selection pressure
- resistant bacteria survive and reproduce
- they pass the resistance allele to their offspring
- the proportion of resistant bacteria increases over generations
- bacteria reproduce rapidly, so this can be observed within a short time
- this shows variation, selection, survival and reproduction, and inheritance, as in Darwin's theory