

Exercise walk-through

Introduction to Natural Selection ■ 7.1

eXercise

You must be able to

- state the conditions for **natural selection** 自然选择 (variation, heritability, overproduction, differential survival)
- explain **fitness** 适合度 as reproductive success
- link selection to changes in a population

Method — The conditions for natural selection

Natural selection requires:

- 1 **Variation** — individuals differ.
- 2 **Heritability** — some variation is inherited.
- 3 **Overproduction** — more offspring are made than can survive.
- 4 **Differential survival/reproduction** — those better suited survive and reproduce more.

Method — Fitness

Fitness is an organism's **reproductive success** — how many surviving offspring it produces, not its strength or size. High-fitness traits become more common.

Method — How the population changes

Individuals with advantageous heritable traits leave more offspring, so those alleles increase in the population over generations — the population **adapts**.

Method — A worked example

In a population of beetles, darker ones are better camouflaged, survive more, and reproduce more; over generations the dark allele becomes more common.

Practice 2.1 ■ 2 marks

State two of the conditions required for natural selection.

Solution 2.1

Method: The conditions for natural selection

Worked steps

Any two: variation, heritability, overproduction, differential survival/reproduction

B1 **B1**.

Practice 2.2 ■ 1 mark

Define fitness in evolutionary terms.

Solution 2.2

Worked steps

An organism's reproductive success (number of surviving offspring) **B1**.

Practice 2.3 ■ 1 mark

Why must the variation be heritable for selection to change a population?

Solution 2.3

Worked steps

Only heritable traits can be passed to offspring, so only they can change the population's makeup over generations **B1**.

Exam-style 3.1 ■ 1 mark

In evolutionary terms, fitness means an organism's

- A** physical strength
- B** reproductive success
- C** body size
- D** lifespan only

Solution 3.1

Method: Fitness

A physical strength

B reproductive success



C body size

D lifespan only

Worked steps

B — reproductive success.

Exam-style 3.2 ■ 3 marks

Dark beetles survive better than light ones on dark soil.

- (a) Explain how natural selection changes the population over generations.
- (b) State the condition that ensures the change is passed on.

Solution 3.2

Method: A worked example

Worked steps

(a) Dark beetles are better camouflaged, so more survive; survivors reproduce more, passing on the dark allele; over generations the dark allele becomes more common **M1 M1 A1**. (b) The trait (color) is heritable **B1**.

Exam-style 3.3 ■ 2 marks

Explain why overproduction of offspring is important for natural selection.

Solution 3.3

Method: The conditions for natural selection

Worked steps

More offspring are produced than can survive, so there is competition; this lets the better-suited individuals survive and reproduce, driving selection **M1** **A1**.