

Exercise walk-through

Variations in Populations ■ 7.11

eXercise

You must be able to

- explain why **genetic diversity** 遗传多样性 helps a population survive change
- link low diversity to extinction risk
- describe how variation arises and is maintained

Method — Variation is raw material

A population with more **genetic variation** has more different traits, so it is **more likely** that some individuals can survive a new challenge (disease, climate change).

Method — Low diversity is risky

A population with **low** genetic diversity (e.g. after a bottleneck) may have **no** individuals able to survive a new threat, raising the **extinction risk**.

Method — Sources of variation

Variation comes from **mutation** (new alleles) and **sexual reproduction** (crossing over, independent assortment, random fertilization mixing alleles).

Method — A worked example

A genetically diverse crop is more likely to include disease-resistant plants; a genetically uniform (monoculture) crop can be wiped out by one disease.

Practice 2.1 ■ 1 mark

Why is genetic diversity useful when the environment changes?

Solution 2.1

Method: Low diversity is risky

Worked steps

It makes it more likely some individuals have traits that let them survive the change

B1.

Practice 2.2 ■ 1 mark

State one source of genetic variation.

Solution 2.2

Method: Variation is raw material

Worked steps

Mutation (or sexual reproduction) **B1**.

Practice 2.3 ■ 1 mark

What is the risk of low genetic diversity?

Solution 2.3

Method: Low diversity is risky

Worked steps

A higher risk of extinction if no individuals can survive a new threat **B1**.

Exam-style 3.1 ■ 1 mark

A population with high genetic diversity is more likely to

- A** go extinct
- B** survive an environmental change
- C** stop reproducing
- D** have identical individuals

Solution 3.1

Method: Variation is raw material

- A go extinct
- B survive an environmental change
- C stop reproducing
- D have identical individuals



Worked steps

B — survive an environmental change.

Exam-style 3.2 ■ 2 marks

A new disease spreads through two populations of the same species.

- (a) Explain why the more genetically diverse population is more likely to survive.
- (b) State one source of the genetic variation.

Solution 3.2

Method: Variation is raw material

Worked steps

(a) A diverse population is more likely to include individuals with resistance to the disease, so some survive and reproduce **M1** **A1**. (b) Mutation (or sexual reproduction) **B1**.

Exam-style 3.3 ■ 2 marks

Explain why a monoculture crop is vulnerable to being destroyed by a single disease.

Solution 3.3

Method: A worked example

Worked steps

A monoculture has almost identical genes, so if the disease can kill one plant it can kill them all — there are no resistant variants to survive **M1** **A1**.