



Niche, allele frequency and conservation: practice questions

8 questions · 30 marks · mark scheme at the back

For Pearson Edexcel International AS Biology XBI11 and International A Level Biology YBI11. **A Level only** is IA2 content (Units 4 to 6), not needed for the International AS.

Name

Total / 30

1 UNIT 2 STYLE [1 mark]

Which condition must be true for the Hardy-Weinberg equation to predict that allele frequencies stay the same?

- A. ☐ The population is small
- B. ☐ Mutations occur frequently
- C. ☐ There is no migration into or out of the population
- D. ☐ Individuals mate with others of the same genotype

2 UNIT 2 STYLE [4 marks]

Cystic fibrosis is caused by a recessive allele. In one population, 1 in 2500 people have cystic fibrosis. Assume the population is in Hardy-Weinberg equilibrium. Calculate the frequency of carriers (heterozygotes) in the population. Show your working.

Answer = ...

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3 UNIT 2 STYLE [3 marks]

Explain how the Hardy-Weinberg equation can be used to find out whether the allele frequency in a population is changing over time.

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4

UNIT 2 STYLE

[4 marks]

Some bacteria in a hospital carry a mutation giving resistance to an antibiotic. Explain how the use of the antibiotic changes the frequency of the resistance allele in the bacterial population.

5

UNIT 2 STYLE

[5 marks]

Describe how reproductive isolation can lead to the formation of new species.

6

UNIT 2 STYLE

[4 marks]

Define the term niche. Describe one behavioural and one anatomical adaptation of an organism to its environment.

UNIT 2 STYLE

[6 marks]

Evaluate the use of zoos and seed banks in the conservation of endangered species and their genetic diversity.

[illegible]

UNIT 2 STYLE

[3 marks]

Seeds stored in a seed bank are dried and then kept at -20°C . Suggest why.

[illegible]

Mark scheme

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

1. [1]

C C: no migration (gene flow) in or out; must also be large, random mating, no mutation, no selection

2. [4]

- $q^2 = 1 \div 2500 = 0.0004$ (1)
- $q = 0.02$ (1)
- $p = 1 - 0.02 = 0.98$ (1)
- $2pq = 2 \times 0.98 \times 0.02 = 0.039$ / 0.0392 (1)

3. [3]

- calculate the expected genotype frequencies (p^2 , $2pq$, q^2) from the allele frequencies
- compare with observed genotype / allele frequencies in later generations
- a difference / change in frequency means allele frequency is changing (the population is evolving)

4. [4]

- mutation produced the resistance allele
- antibiotic is a selection pressure / kills non-resistant bacteria
- resistant bacteria survive and reproduce
- pass on the resistance allele to offspring, so the frequency of the allele increases in the population
- over many generations / bacteria divide rapidly, so the change happens quickly
- Max 4

5. [5]

- populations are separated / cannot interbreed (for example by a geographical barrier)
- no gene flow between the populations
- mutations occur independently, creating different alleles
- different environments give different selection pressures, so different alleles are selected
- allele frequencies / gene pools change and become increasingly different
- eventually the populations cannot interbreed to produce fertile offspring
- Max 5

6. [4]

- niche: the role of a species in its habitat / how it obtains resources and its interactions with other species
- behavioural: named behaviour (for example nocturnal activity, hibernation, migration) in a named organism
- anatomical: named structural feature (for example thick fur, rolled leaves with hairs) in a named organism
- link of one adaptation to survival (for example reducing heat loss or water loss)

7. [6]

- zoos: captive breeding programmes increase numbers of endangered animals
- zoos: managed breeding / exchanging animals between zoos maintains genetic diversity and avoids inbreeding
- zoos: reintroduction and research and education support wild conservation
- zoos: limitation: expensive, few individuals, small populations lose genetic diversity, animals may not adapt to the wild
- seed banks: cheap, small space, store many seeds from many species and alleles
- seed banks: limitation: some seeds cannot be stored, seeds lose viability, plants do not adapt to changing conditions
- reasoned conclusion: both are useful but habitat protection is also needed
- Max 6

8. [3]

- drying reduces water content so seeds do not germinate / metabolic reactions slow / fungi do not grow
- low water content prevents ice crystals forming that would damage cells
- low temperature slows respiration / metabolism / enzyme activity, so seeds remain viable for longer