

2.8 Niches, Hardy-Weinberg and conservation

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

KEY WORDS niche • anatomical • physiological • behavioural
• Hardy-Weinberg equation –

Objective

Practise statements 4.19-4.21: niches and the three kinds of adaptation, the Hardy-Weinberg equation with its conditions, and evaluating conservation programmes.

1 Key knowledge and worked examples

■ Niche and adaptations

A niche is the full way of life: what a species uses, tolerates and does. Adaptations come as **anatomical** (structures), **physiological** (internal processes) and **behavioural** (actions) – exam answers should name the kind as well as the example.

■ Hardy–Weinberg –

$$p^2 + 2pq + q^2 = 1$$

for a large, randomly mating population with no selection, mutation or migration. $p + q = 1$. Given the recessive phenotype frequency q^2 , take the square root, then compute carriers $2pq$. A generation where the numbers drift from prediction is evidence that one condition is failing – usually selection.

■ Worked example: carriers from phenotype counts

In a sample of 2 000 mice, 128 are albino (recessive). $q^2 = 128/2000 = 0.064$, so $q = 0.25$, $p = 0.75$. Expected heterozygotes = $2pq \times 2000 = 0.375 \times 2000 = 750$. If the next generation’s albino count is far from $0.064 \times$ births, something – selection, migration or non-random mating – is acting.

■ Conservation evaluation

Zoos and seed banks: protection from hunters and weather, captive breeding, research and education – but limited numbers, cost, lost behaviours and no ecosystem role in the wild. Habitat protection and corridors: whole communities and natural selection preserved – but land conflicts and slow recovery. Exam credit goes to the mechanism, the numbers and the trade-off.

2 Practice

2.1 Classify these adaptations as anatomical, physiological or behavioural: a thick blubber layer; hibernation; bacteria-resistant stomach acid. [3]

2.2 State two conditions for the Hardy-Weinberg equation to hold. [2]

2.3 In a population, $q = 0.2$. State p and calculate $2pq$. [2]

3 Exam-style questions

3.1 A population of 4 000 tigers contains 400 that are homozygous recessive for a coat pattern. Calculate q and p , the expected number of carriers, and the expected number of homozygous dominant tigers. [4]

3.2 A wildlife park's tigers show allele frequencies drifting from Hardy-Weinberg predictions within two generations. Suggest two possible causes of the drift, and explain why a small captive population is especially prone to it. [5]

3.3 A conservation plan for an island fox proposes captive breeding in a new facility. Discuss two advantages and two disadvantages of captive breeding compared with protecting and expanding the foxes' habitat. [6]
