

2.7 Classification and measuring biodiversity

Name: _____ Class: _____ Date: _____ Total: 20 marks

KEY WORDS three-domain system • species richness
• index of diversity • heterozygosity index • endemic

Objective

Practise statements 4.14-4.18: the three-domain classification, species richness, the index of diversity D, the heterozygosity index and endemism – the calculation centre of WBI12.

1 Key knowledge and worked examples

■ Classification and the three domains

Classification groups life by shared characteristics, tested ever more sharply by molecular evidence – ribosomal RNA sequencing split the old prokaryotes into **Bacteria** and **Archaea**, with everything else in **Eukarya**.

■ The index of diversity

$$D = \frac{N(N - 1)}{\sum n(n - 1)}$$

N = total individuals of all species; n = individuals of one species. Higher D = more diverse. Species richness alone ignores balance.

■ Heterozygosity index

$H = \frac{\text{number of heterozygotes}}{\text{number of individuals sampled}}$ – genetic diversity within one species. Low H warns of inbreeding.

■ Worked example: full D calculation

Four species with counts 60, 20, 15, 5; $N = 100$. Numerator $100 \times 99 = 9900$. Denominator $= 60 \times 59 + 20 \times 19 + 15 \times 14 + 5 \times 4 = 3540 + 380 + 210 + 20 = 4150$. $D = 9900/4150 = 2.39$. If one pesticide removed the last two species (N stays 100 only in count – recompute with 80, 20: $D = 9900/(6320 + 380) = 1.48$): diversity collapses even though richness fell only by two.

2 Practice

2.1 State the difference between species richness and the index of diversity. [2]

2.2 Name the three domains of life. [1]

2.3 A lake holds 200 fish: 120 of species A, 80 of species B. Calculate D. [2]

3 Exam-style questions

3.1 The table gives the plants of two meadows.

Species	Meadow 1 count	Meadow 2 count
Grass A	70	20
Grass B	10	20
Clover	10	20
Orchid	10	20
Total	100	80

Calculate D for each meadow, state which is more diverse, and explain why the meadows can have the same species richness and still differ in diversity. [6]

3.2 An island lizard population of 400 includes 60 heterozygotes at a coat-colour locus. Calculate the heterozygosity index, compare it with a mainland population where 200 of 400 are heterozygotes, and explain why a low index matters for the island population's future. [4]

3.3 The tuatara lives only on small islands off New Zealand. Define the term describing this distribution, explain why such a species is unusually vulnerable to extinction, and describe one conservation method that directly increases its population size. [5]
