4.5 Evolution and speciation

Name: _____ Class: _____ Date: _____ **Total: 19 marks**

KEY WORDS allele frequency • directional selection • stabilising selection • allopatric • sympatric

Objective

Practise statements 5.23-5.26: evolution as change in allele frequency, selection types, isolation and speciation (allopatric and sympatric), judging controversial conclusions, and sustainability measures including reforestation and biofuels.

1 Key knowledge and worked examples

■ Evolution , defined exactly

A change in **allele frequency** in a population. Sources of new alleles: mutation. The filters: **directional selection** (environment shifts – one extreme favoured, the mean moves), **stabilising selection** (stable environment – extremes trimmed), **genetic drift** (chance, strong in small populations), **gene flow** (migration).

■ Speciation

Isolation first: **allopatric** – physical barrier (sea, mountain); **sympatric** – reproductive isolation in one place (behavioural, seasonal, mechanical). The isolated populations' allele frequencies drift and are selected apart until interbreeding fails: two species.

■ Judging a controversial claim

Check the evidence chain: data quality, alternative explanations, mechanism, replication. "Controversial" often means the data admit more than one reading – say which reading each side takes.

■ Worked example: a selection story in three sentences

Antibiotic present → bacteria with resistance alleles survive preferentially (selection) → their allele frequency rises each generation (evolution). Completing the course removes the selection pressure's beneficiaries – resistant cells – before they multiply.

2 Practice

2.1 Define evolution in terms of alleles. [1]

2.2 Contrast directional and stabilising selection. [2]

2.3 State the difference between allopatric and sympatric speciation. [2]

3 Exam-style questions

3.1 Hawthorn flies lay eggs in hawthorn fruit; a population on apple trees now lays in apples and mates on apple trees only. Explain how this sympatric split began and how it leads to two species, even with no physical barrier. [5]

3.2 The frequency of a recessive allele falls from 0.20 to 0.05 over eight generations in a fish population after an introduced predator. Explain the change in terms of selection, and predict what would happen to the frequency if the predator were removed. [4]

3.3 A paper concludes "reforestation cannot offset national emissions." Describe two pieces of evidence you would want before judging the claim, and explain how each could support or undermine it. [5]