



QUESTION WORKBOOK

Two genes at once: 9 : 3 : 3 : 1, the ways it breaks, and the chi-squared test

Inheritance and population genetics · Unit B16

AQA 3.7.1 · OCR A 6.1.2 · Edexcel A Topic 3 (dihybrid crosses only) · CAIE 16.2

6 questions · 21 marks

NAVY SCREEN EDITION

SECTION A · Short, 1 to 2 marks

- A1** State the phenotype ratio expected among the offspring of a cross between two organisms heterozygous at two unlinked loci, and state the ratio expected from a dihybrid test cross. [2]

SECTION B · Standard, 3 to 5 marks

- B1** Two rodents heterozygous at two loci are crossed and produce 160 offspring: 84 black, 36 brown and 40 white. Recessive epistasis predicts a 9 : 3 : 4 ratio. Calculate the value of chi-squared for these results, and state whether the difference between observed and expected numbers is significant at $p = 0.05$. [5]

- B2** A pea plant of genotype $RrYy$ is crossed with a plant of genotype $rryy$. Explain why four phenotypes are expected among the offspring in equal numbers, and explain what a large departure from those equal numbers would suggest. [4]

B3 In a flowering plant, two enzymes act one after the other to convert a colourless precursor into a purple pigment. A cross between two plants heterozygous at both loci gives 9 purple : 7 white offspring. Suggest an explanation for this ratio. [4]

B4 A test cross between a doubly heterozygous fruit fly and a double recessive produces 300 offspring in four phenotype classes: 145, 15, 12 and 128. Calculate the recombination frequency for these two genes. [3]

B5 Compare the effect of autosomal linkage with the effect of epistasis on the offspring numbers obtained from a cross involving two genes. [3]
