



QUESTION WORKBOOK

Statistics for biologists: spread, error bars and the three tests

Scientific method and quantitative biology · Unit B00

AQA MS 1.2, 1.3, 1.5–1.7, 1.9–1.11 · OCR A Module 1.1.4; mathematical requirements (statistics)
Edexcel A Mathematical skills appendix (statistics)
CAIE Paper 5 (analysis, conclusions and evaluation)

6 questions · 22 marks

NAVY SCREEN EDITION

SECTION A · Short, 1 to 2 marks

- A1** An investigation compares the mean number of stomata per square millimetre on leaves grown in sun and on leaves grown in shade. State a suitable null hypothesis, and state the significance level conventionally used in biology. [2]

SECTION B · Standard, 3 to 5 marks

- B1** Two heterozygous pea plants are crossed and the offspring are expected in a ratio of 3 tall to 1 dwarf. Of 400 offspring, 280 are tall and 120 are dwarf. Calculate chi-squared and use it to reach a conclusion. The critical value at $p = 0.05$ with 1 degree of freedom is 3.84. [5]

- B2** Five leaves taken from one shrub have widths of 12, 14, 15, 17 and 22 mm. Calculate the mean width and the standard deviation of these widths, giving the standard deviation to three significant figures. [4]

B3 A student writes that the error bars on two mean values do not overlap, so the difference between the means is significant. Explain why this reasoning is unsound. [4]

B4 Compare Student's t-test with Spearman's rank correlation, referring to the data each one needs and the question each one answers. [4]

B5 A researcher measures 2000 fish from each of two lakes and reports that the mean masses differ by 0.4 g, a difference a t-test finds significant at $p = 0.05$. Suggest why this significant result may still be of little biological interest. [3]
