



QUESTION WORKBOOK

Uncertainty and error

Measurements · Year 12

AQA 3.1.2 · CIE 1.3 · OCR A 2.2.1

10 questions · 30 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 Distinguish between random errors and systematic errors. [2]

A2 A length is measured as 2.50 ± 0.05 m. Calculate the percentage uncertainty. [2]

A3 Distinguish between the precision and the accuracy of a set of measurements. [2]

SECTION B · Standard

B1 Two lengths, 3.0 ± 0.1 m and 5.0 ± 0.2 m, are added. State the total length and its absolute uncertainty. [3]

- B2** A rectangle has length 10.0 ± 0.2 cm and width 5.0 ± 0.1 cm. Calculate its area and the absolute uncertainty in the area. [4]

- B3** A length of 45 mm is measured with a ruler of 1 mm resolution, giving a reading uncertainty of ± 0.5 mm. Calculate the percentage uncertainty. [3]

- B4** Four repeated readings of a length are 20.1, 20.3, 20.2 and 20.4 mm. Calculate the mean and estimate its uncertainty from the range. [3]

SECTION C · Stretch

- C1** The radius of a circle is 4.0 ± 0.1 cm. Calculate the area and its absolute uncertainty (area = πr^2). [4]

- C2** A density is found from $\rho = m/V$, with $m = 0.500 \pm 0.005$ kg and $V = 2.0 \times 10^{-4} \pm 0.1 \times 10^{-4}$ m³. Calculate the density and its absolute uncertainty. [4]

- C3** State how you would reduce (a) a random error and (b) a systematic error in an experiment. [3]