



QUESTION WORKBOOK

Estimation and orders of magnitude

Measurements · Year 12

AQA 3.1.3 · CIE 1.1 · OCR A 2.1.1

10 questions · 30 marks

PRINT EDITION

SECTION A · Warm-up

A1 State what is meant by the order of magnitude of a quantity. [2]

A2 State the order of magnitude of (a) the mass of an apple and (b) the speed of a car on a motorway. [2]

A3 Give the order of magnitude of (a) 4.5×10^6 and (b) 2.0×10^{-4} . [2]

SECTION B · Standard

B1 Estimate the number of times a human heart beats in a lifetime, and give the answer to the nearest order of magnitude. (Take about 70 beats per minute and a lifetime of about 80 years.) [3]

B2 Estimate how many 1 cm^3 cubes would fit inside a 1 m^3 box. [3]

B3 Estimate the kinetic energy of a person running, and give the order of magnitude. (Take a mass of about 70 kg and a speed of about 5 m s^{-1} .) [4]

B4 Estimate the order of magnitude of the ratio of the mass of the Earth ($\approx 6 \times 10^{24} \text{ kg}$) to the mass of a person ($\approx 60 \text{ kg}$). [3]

SECTION C · Stretch

C1 Estimate the number of breaths a person takes in one day, and express it to the nearest order of magnitude. (Take about 15 breaths per minute.) [4]

- C2** Estimate the energy needed to heat a mug of water for a hot drink. (Take about 0.25 kg of water, $c = 4200 \text{ J kg}^{-1} \text{ K}^{-1}$ and a temperature rise of about 80°C .) [4]

- C3** Explain why order-of-magnitude estimates are useful in physics. [3]