



QUESTION WORKBOOK

Fission and fusion

Nuclear physics · Year 13

AQA 3.8.1.6, 3.8.1.7 · CIE 23.1 · OCR A 6.4.4

10 questions · 31 marks

PRINT EDITION

SECTION A · Warm-up

A1 Describe what happens in induced nuclear fission. [2]

A2 Explain what is meant by a chain reaction. [2]

A3 State what is meant by the critical mass of a fissile material. [2]

SECTION B · Standard

B1 Complete and balance the fission reaction: $^{235}_{92}\text{U} + {}^1_0\text{n} \rightarrow {}^{141}_{56}\text{Ba} + {}^{92}_{36}\text{Kr} + x {}^1_0\text{n}$. Find x , and check the proton numbers balance. [4]

- B2** A single fission event converts a mass of 3.5×10^{-28} kg into energy. Calculate the energy released, in joules and in MeV ($c = 3.0 \times 10^8$ m s⁻¹, 1 MeV = 1.60×10^{-13} J).

[4]

- B3** Explain why very high temperatures are needed for nuclear fusion to occur.

[3]

- B4** A fusion reaction releases 17.6 MeV of energy. Calculate the energy in joules and the mass converted ($c = 3.0 \times 10^8$ m s⁻¹).

[3]

SECTION C · Stretch

- C1** Each fission of a uranium-235 nucleus releases about 200 MeV. Estimate the energy released by the complete fission of 1.0 kg of uranium-235 ($N_A = 6.02 \times 10^{23} \text{ mol}^{-1}$, $1 \text{ MeV} = 1.60 \times 10^{-13} \text{ J}$). [4]

- C2** Compare nuclear fission and nuclear fusion in terms of the fuel used, the conditions required and the products. [4]

- C3** Using the binding energy per nucleon curve, explain why energy is released in both fission and fusion. [3]