



QUESTION WORKBOOK

Conservation laws

Particles · Year 12

AQA 3.2.1.7 · CIE 11.1, 11.2 · OCR A 6.4.2

10 questions · 31 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 State four quantities that are always conserved in particle interactions. [2]

A2 Describe the change in a quark that occurs in beta-minus decay. [2]

A3 Describe the change in a quark that occurs in beta-plus decay. [2]

SECTION B · Standard

B1 Check whether the interaction $p + p \rightarrow p + n + \pi^+$ conserves charge and baryon number (π^+ is a meson of charge +1). [4]

B2 Explain what conservation of strangeness tells you about whether an interaction proceeds by the strong or the weak interaction. [3]

B3 For the decay $n \rightarrow p + e^- + \text{anti-}\nu_e$, audit charge, baryon number and lepton number. [4]

B4 A student suggests the decay $p \rightarrow n + e^+$ could occur on its own. Explain why this cannot be a complete interaction. [3]

SECTION C · Stretch

- C1** In the interaction $p + p \rightarrow p + n + X$, the particle X is a meson. Using conservation of charge and baryon number, determine the charge and baryon number of X . [4]

- C2** A strong interaction produces two strange particles: $\pi^- + p \rightarrow K^0 + X$, where K^0 has strangeness $+1$. State the strangeness of X and explain your reasoning. [4]

- C3** Explain why energy and momentum are conserved in every particle interaction, whatever the interaction involved. [3]