



QUESTION WORKBOOK

Quarks and antiquarks

Particles · Year 12

AQA 3.2.1.6 · CIE 11.2 · OCR A 6.4.2

10 questions · 30 marks

NAVY SCREEN EDITION

SECTION A · Warm-up

A1 State the electric charge of the up quark and of the down quark, as fractions of the elementary charge e . [2]

A2 State the quark composition of a proton and of a neutron. [2]

A3 State the baryon number of a single quark. [2]

SECTION B · Standard

B1 Show, using the quark charges, that a proton (uud) has a charge of $+1e$. [3]

B2 Show, using the quark charges, that a neutron (udd) has a charge of 0. [3]

- B3** A positive pion is made of an up quark and an anti-down quark. Calculate its charge and its baryon number, showing your working. [4]

- B4** State the quark composition of an antiproton and show that its charge is $-1e$. [3]

SECTION C · Stretch

- C1** Describe the beta-minus decay of a neutron in terms of its quarks, naming what the changed quark becomes and the particles emitted. [4]

- C2** A positive kaon is made of an up quark and an anti-strange quark. The anti-strange quark has charge $+1/3 e$ and strangeness $+1$. State the charge and the strangeness of the K^+ . [4]

- C3** Explain why the quark model assigns the neutron the composition udd rather than uud . [3]