



ANSWER BOOK

Classification of particles

Particles · Year 12

AQA 3.2.1.5 · CIE 11.2 · OCR A 6.4.2

10 questions · 30 marks

NAVY EDITION

SECTION A · Warm-up

- A1** Hadrons feel the strong interaction; leptons do not. (Hadrons are further split into baryons and mesons.) [2]
- A2** A baryon is a hadron made of three quarks (baryon number +1), such as the proton or neutron. A meson is a hadron made of a quark and an antiquark (baryon number 0), such as a pion or kaon. [2]
- A3** Any two of: the electron, the muon, the electron neutrino, the muon neutrino (and their antiparticles). [2]

SECTION B · Standard

- B1** Baryon +1, antibaryon -1, meson 0. Baryon number is a conserved quantity: in any allowed interaction the total baryon number before equals the total afterwards. [3]
- B2** Electron: $L_e = +1$. Positron: $L_e = -1$. Electron antineutrino: $L_e = -1$. [3]
- B3** Baryon number: $1 \rightarrow 1 + 0 + 0 = 1 \checkmark$. Lepton number: $0 \rightarrow 0 + (+1) + (-1) = 0 \checkmark$ (the electron has $L_e = +1$ and the antineutrino $L_e = -1$). [3]
- B4** Strange particles are produced through the strong interaction (in pairs), but decay through the weak interaction. Strangeness is conserved in strong interactions but can change (by 0 or ± 1) in weak interactions. [3]

SECTION C · Stretch

- C1** Charge: $(+1) + (-1) = 0 \rightarrow 0 + 0 = 0 \checkmark$. Baryon number: $1 + 0 = 1 \rightarrow 1 + 0 = 1 \checkmark$. Lepton number: $0 + (+1) = +1 \rightarrow 0 + (+1) = +1 \checkmark$. All are conserved, so the interaction is allowed. [4]
- C2** Proton: baryon. Pion: meson. Muon: lepton. Neutron: baryon. Electron neutrino: lepton. [4]
- C3** Leptons are fundamental (not made of quarks) and do not feel the strong interaction; hadrons are made of quarks and do feel the strong interaction. [3]