GET BETTER AT PHYSICS · MARK SCHEME

Conservation Laws & Particle Equations: tiered multiple choice

AQA A-level Physics · 7407 / 7408 · Specification 3.2.1.7 · 5 questions · 5 marks

1 mark per correct letter | Worked reasoning for every question | **How students did** = from AQA examiner reports, where available

Answer key

Q1	Q2	Q3	Q4	Q5
B	C	A	A	D

Easy

Questions 1–5

1 **B**

The particle emitted with a β^- particle · AQA June 2018 · A-level Paper 1 · Q12

β^- decay emits an electron (lepton number +1). Lepton number must stay 0, so Y has lepton number −1: it is an electron antineutrino, an antiparticle. It is neutral and does not feel the strong interaction.

How students did: 89.2% of students got this right in June 2018.

2 **C**

Products of a neutral kaon decay · AQA June 2018 · AS Paper 2 · Q8

Charge: 0 = X + Y + 0, so X and Y have opposite charges. Lepton number: $\bar{\nu}_e$ has −1, so X and Y must have total electron lepton number +1. π^+ (lepton number 0) and e^- (+1) satisfy both: C.

Watch out: A (e^+ and e^-) has total lepton number 0, so with $\bar{\nu}_e$ the total would be −1.

How students did: 70.1% of students got this right in June 2018.

3 **A**

Quark composition from a strong interaction · AQA June 2018 · A-level Paper 1 · Q11

Quarks on the left: π^+ ($u\bar{d}$) + n (udd). Net: two u, one d (one d cancels the $\bar{d}$). The Σ^0 uses u, d and s, leaving one u. Strangeness is conserved in the strong interaction, so X must carry $\bar{s}$ to cancel the s: X = $u\bar{s}$ (a K^+).

How students did: 68.0% of students got this right in June 2018.

4 **A**

Products of free neutron decay · AQA June 2023 · AS Paper 2 · Q16

$n \rightarrow p + e^- + \bar{\nu}_e$. Charge: 0 = +1 − 1 + 0. Lepton number: 0 = 0 + 1 − 1, so the electron must come with an antineutrino.

How students did: At least 65% of students got this right in June 2023.

5 **D**

Which K^+ decay is possible? · AQA 2020 · AS Paper 2 · Q9

Check each option. A: lepton number 0 → (−1) + (−1) = −2 for e^+ and $\bar{\nu}_e$ ×. B: baryon number 0 → +1 ×. C: charge +1 → +2 ×. D: charge +1 → +1 ✓, baryon number 0 → 0 ✓, muon lepton number 0 → (−1) + (+1) = 0 ✓. Only D is possible.

Watch out: Check charge, baryon number and lepton number for every option before choosing.

End of mark scheme. Answers from AQA's published keys; explanations written for this pack. AQA material is © AQA. More free packs and 1-to-1 tuition: **www.getbetteratphysics.co.uk**

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