GET BETTER AT PHYSICS · MARK SCHEME

Antiparticles, Pair Production & Annihilation: tiered multiple choice

Edexcel IAL Physics · Unit 4 (WPH14) · Specification points 122 · 5 questions · 5 marks

1 mark per correct letter | Worked reasoning for every question

How students did = from Pearson examiner reports, where available

Answer key

Q1	Q2	Q3	Q4	Q5
D	B	D	D	C

Easy

Questions 1–4

1 **D**

Maximum mass from pair production · Edexcel IAL January 2020 · Unit 4 · Q6

The 18 MeV is shared between the particle and its antiparticle, which have equal mass, so each can have at most 9 MeV of rest energy. $m = E/c^2 = (9 \times 10^6 \times 1.6 \times 10^{-19})/(3 \times 10^8)^2$ kg.

Watch out: Convert MeV to J ($\times 10^6 \times 1.6 \times 10^{-19}$) and divide by c^2, not c.

How students did: 97% of students got this right in January 2020.

2 **B**

Mass and charge of an anti-proton · Edexcel IAL October 2022 · Unit 4 · Q1

An anti-proton has the same mass as a proton (1.67×10^{-27} kg) and the opposite charge (-1.6×10^{-19} C).

How students did: 87% of students got this right in October 2022.

3 **D**

Charge and mass of an antiproton · Edexcel IAL January 2022 · Unit 4 · Q2

An antiparticle has the same mass as its particle but opposite charge. An antiproton has mass 1.67×10^{-27} kg (a proton's mass) and charge -1.6×10^{-19} C.

Watch out: Mass is never negative; only properties like charge are reversed.

How students did: 81% of students got this right in January 2022.

4 **D**

Comparing an electron and a positron · Edexcel IAL January 2025 · Unit 4 · Q4

A particle and its antiparticle have the same mass but opposite charge and opposite quantum numbers. The electron has lepton number +1 and the positron −1, so they have the same mass but different lepton numbers. Neither has a baryon number.

Medium

Question 5

5 **C**

Maximum mass of a pair created by annihilation · Edexcel IAL October 2024 · Unit 4 · Q10

The total energy available is 2 × 450 GeV = 900 GeV, shared equally between the particle and antiparticle. Each can therefore have up to 450 GeV of rest energy: $m = (450 \times 10^{9} \times 1.6 \times 10^{-19})/(3.00 \times 10^{8})^{2}$ kg.

> **Watch out:** GeV means $\times 10^{9}$, not $\times 10^{6}$.

How students did: 39% of students got this right in October 2024.

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

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