Practice Question Set For A-Level
Subject : Physics
Paper-1 Topic: Particle And Radiation

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Name of the Student:_____

Max. Marks : 20 Marks   **Time : 20 Minutes**

Mark Schemes

Q1.

(a)   atoms/nuclei with same number of protons/atomic number ✔
             atom/nuclei seen at least once

1

but different numbers of neutrons/mass number ✔

1

(b)   momentum must be conserved ✔

1

so need two photons travelling in different directions ✔

1

(c)   rest energy = 2 × 3728 = 7456 ✔ (MeV)
             must show doubling OR explain that is halved because two photons
             OR implied because 1.193 × 10⁻⁹

$$\text{rest energy} = 2 \times 3728 = 7456 \; (MeV)$$

1

rest energy = 1.193 × 10⁻⁹ ✔ (J)

$$\text{rest energy} = 1.193 \times 10^{-9} \; (J)$$

1

use of energy of each photon = *hf* ✔
             no working but correct answer scores last three marks

1

$f = (1.193 \times 10^{-9}/2) /6.63 \times 10^{-34} = 8.997 \times 10^{23}$ ✔ (Hz)
             RANGE: 8.90 × 10²³ − 9.00 × 10²³

1

(d) $^{1}_{0}\overline{n} \rightarrow ^{1}_{-1}\overline{p} + ^{0}_{1}\overline{e} + \nu_{(e)}$ ✔✔
             Can use e⁺ OR β in place of e

1

             Allow slight loop in bottom of neutrino but must not look like gamma

1

(e)

electromagnetic	
gravitational	
strong nuclear	
weak nuclear	✔

1

[11]

Q2.
(a)   (isotopes have)

same number of protons ✔

        allow atomic mass / proton number

different numbers of neutrons ✔

        allow mass number / nucleon number
        TO where mix up atomic number and mass number

2

(b) $92 \times 1.60 \times 10^{-19}$ ✔

        correct power
        penalise minus sign on answer line

    $(+)1.47 \times 10^{-17}$ (C) ✔

        Allow 2 sf answer 1.5×10^{-17} (C)
        Pay attention to powers on answer line

2

(c) $(4.8 \times 10^{-19} \div 1.60 \times 10^{-19} =)\ 3$ ✔

        or
        $1.47 \times 10^{-17} - 4.8 \times 10^{-19}\ (= Q)$ (ecf)
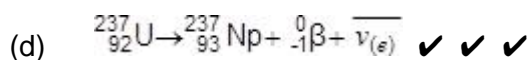
    $(92 - 3 =)\ 89$ ✔

        95 on answer line 1 mark

$$\left(n = \frac{Q}{e} = \frac{1.47 \times 10^{-17} - 4.8 \times 10^{-19}}{1.6 \times 10^{-19}}\right) = 89\ (ecf)$$

        Integer value for n

2

(d) $^{237}_{92}U \rightarrow\ ^{237}_{93}Np +\ ^{0}_{-1}\beta + \overline{v_{(e)}}$ ✔ ✔ ✔

        one mark for:
        • *both numbers correct on Np*
        • *both numbers correct on β^-*
        • *correct symbol for (electron) antineutrino*

3

[9]