**Name of the Student**:_____
**Max. Marks : 20 Marks** **Time : 20 Minutes**

Mark Schemes

## Q1.

(a) (i) energy released when the separate nucleons combine to form the nucleus

**or** energy needed to separate the nucleus into individual nucleons owtte

B1 **1**

(ii) BE in J = $8 \times 1.1314027 \times 10^{-12}$ ($9.05122 \times 10^{-12}$)

C1

BE in eV = $5.6570135 \times 10^{7}$ eV or BE/nucleon
= $7.07 \times 10^{6}$ MeV

C1

56.570135 (MeV) (condone 3 sf consistent with electron charge)

A1 **3**

(b) (i) change in BE = $0.0147120 (\times 10^{-12})$ J

C1

use of $E = mc^2$ with their energy $1.635 \times 10^{-31}$ kg

A1 **2**

(ii) use of charge on alpha particles = 2 *e*

C1

attempt to substitute in PE = $\frac{qQ}{4\pi\varepsilon_0 r}$

C1

$2.4(2.39) \times 10^{-13}$ J

A1

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3

(ii) the mass of Be > mass of 2 He nuclei

B1

explains that when they touch there is zero KE
only mass available is that of the two alpha particles

B1

extra KE provides the increase in mass of the beryllium-8
compared with the 2 He nuclei

B1

3

**[12]**

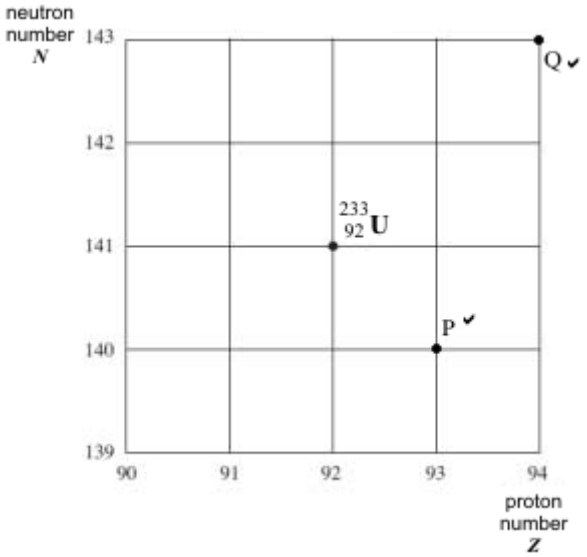
## Q2.

(a) $^{231}_{91}$Pa ✓

anti (electron) neutrino ✓

2

(b)




2

(c) (i) $x = 4$ ✓

1

(ii) mass defect = [(232.98915 + 1.00867) –
(90.90368 + 138.87810 + 4 × 1.00867)] u ✓

= 0.18136 u ✓

3

energy released (= 0.18136 × 931) = 169 (MeV) ✓

**[8]**

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