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

Mark Schemes

Q1.

(a) R (= $r_0A^{1/3}$) = $1.3 \times 10^{-5} \times (238)^{1/3}$ **(1)**
= $8.0(6) \times 10^{-15}$m **(1)**

2

(b) (use of inverse square law e.g. $\frac{I_1}{I_2} = \left(\frac{x_1}{x_2}\right)^2$ gives)

$10 = \left(\frac{x_2}{0.03}\right)^2$ **(1)**

x = 0.095 m **(1)**
(0.0949 m)

2

(c) (use *of* $A = A_o exp(-\lambda t$ gives) $0.85 = 1.0 \exp(-\lambda 52)$ **(1)**

$\lambda = \frac{\ln(100/0.85}{52}$ **(1)**

= $3.1(3) \times 10^{-3}s^{-1}$ **(1)**

3

(d) it only emits *γ* rays **(1)**
relevant properties of γ radiation e.g. may be detected outside the body/weak ioniser and causes little damage **(1)**
it has a short enough half-life and will not remain active in the body after use **(1)**
it has a long enough half-life to remain active during diagnosis **(1)**
the substance has a toxicity that can be tolerated by the body **(1)**
it may be prepared on site **(1)**

any three **(1)(1)(1)**

3

[10]

Q2.

(a) graph passes through N = 10/11 when Z = 10 and N increases as Z increases **(1)**
N = 115 → 125 when Z = 80 and graph must bend upwards **(1)**

2

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(b) (i) **W** at $Z > 60$ just (within one diagonal of a square) below line **(1)**

(ii) **X** just (within one diagonal of a square) above line **(1)**

(iii) **Y** just (within one diagonal of a square) below line **(1)**

3

(c) working showing the change due to emission of four α particles **(1)**
four β^- particles **(1)**

1

(d) Any **two** from the following list of processes:

β^+
describe the changes to *N* (up by 1) and *Z* (down by 1)
[or allow p change to n]

α
move closer to line of stability
[or state the proton to neutron ratio is reduced]

p
only if nuclide is **very** proton rich
[or electrostatic repulsion has to overcome the strong nuclear force]
[or highly unstable]
[or rare process]

e^- capture
describe the changes to *N* (up by 1) and *Z* (down by 1)
allow p changes to n

marking: listing **two** processes **(1)**
discussing **each** of the two processes **(1) (1)**

3
QWC 1

[10]

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