Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Mark Schemes

Q1.

Question Number	Answer		Mark
(a)(i)	Alpha particles ionise the air **Or** alpha particles strip electrons from air molecules	(1)	
	The ions/electrons move (in the electric field between the plates)	(1)	2
(a)(ii)	Smoke particles capture electrons (and reduce the free charge able to move) **Or** alpha particles collide with smoke particles and reduce amount of ionisation	(1)	1
(b)(i)	Random means we cannot identify which atom/nucleus will be the next to decay **Or** we cannot identify when an individual atom/nucleus will decay **Or** we cannot state exactly how many atoms/nuclei will decay in a set time **Or** we can only estimate the fraction that will decay in the next time interval	(1)	
	Spontaneous means that the decay cannot be influenced by any (external) factors.	(1)	2
(b)(ii)	$_{95}\mathrm{Am} \rightarrow {}^{237}\mathrm{Np} + {}^{4}_{2}\alpha$ Top line correct Bottom line correct	(1) (1)	2
	Total for question		7

Q2.

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Question Number	Acceptable answers	Additional guidance	Mark
	• Calculates change in mass (1) • Converts from u to kg (1) • Use of $\Delta E = c^2 \Delta m$ (1) • Use of $E_k = ½ mv^2$ (1) • $v = 1.4 \times 10^7$ m s^{-1}	Example of calculation $\Delta m = 238.0003u - (233.9942 + 4.0015)u$ $= 0.00463 \times 1.66 \times 10^{-27}$ kg $= 7.636 \times 10^{-30}$ kg $\Delta E = (3.00 \times 10^8 \text{ m s}^{-1})^2 \times 7.636 \times 10^{-30}$ kg $= 6.872 \times 10^{-13}$ J 6.872×10^{-13} J $= ½ (4.0015\ u)\ v^2$ $v = 1.4 \times 10^7$ m s^{-1}	5

Q3.

Question Number	Acceptable answers	Additional guidance	Mark
	• Top line correct (1) • Bottom line correct (1)	Example of calculation: $^{87}_{37}\text{Rb} \rightarrow {}^{87}_{38}\text{Sr} + {}^{0}_{-1}\beta^- + \bar{\nu}_e$	2

Q4.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• Counting for 1 minute is too short a time **Or** he should count for at least 3 minutes (1) (1) • He hasn't recorded the background count rate (1) • More than one reading taken and a mean calculated **Or** should have taken more than two readings (to calculate mean)		3

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