Question Number	Answer	Mark
15(a)(i)	Mass difference calculation (1) Use of $\Delta E = c^2 \Delta m$ (1) $\Delta E = 8.7 \times 10^{-13}$ (J) (1) Example of calculation $\Delta m = (3.48572 - 3.41918 - 0.0664437) \times 10^{-25}\ \text{kg} = 9.63 \times 10^{-30}\text{kg}$ $\Delta E = (3.00 \times 10^8\ \text{m s}^{-1})^2 \times 9.63 \times 10^{-30}\ \text{kg} = 8.67 \times 10^{-1}\ \ \text{J}$	**3**
15(a)(ii)	Use of $E_\text{k} = \frac{1}{2}mv^2$ (1) $v = 1.6 \times 10^7\ \text{m s}^{-1}$ (allow ecf from (a)(i)) (1) Example of calculation $0.98 \times 8.67 \times 10^{-1}\ \ \text{J} = \frac{1}{2} \times 6.64437 \times 10^{-27}\ \text{kg} \times v^2$ $\therefore v = \sqrt{\frac{2 \times 0.98 \times 8.67 \times 10^{-13}\ \text{J}}{6.64437 \times 10^{-27}\ \text{kg}}} = 1.60 \times 10^7\ \text{m s}^{-1}$	**2**
15(b)	Momentum must be conserved (in the decay) (1) The lead nucleus must recoil after the decay **Or** the lead nucleus moves in the opposite direction to the alpha particle (1)	**2**
	Total for question 15	**7**