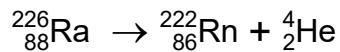


- 7 (a) The ^{226}Ra nucleus undergoes alpha decay according to



Data for the nuclei in the reaction are given in Fig. 7.1.

nucleus	mass / u
$^{226}_{88}\text{Ra}$	226.0254
$^{222}_{86}\text{Rn}$	222.0176
^4_2He	4.0026

Fig. 7.1

- (i) Show that the energy released in this decay, Q, is 4.86 MeV.

[2]

- (ii) This energy, Q, must be shared by the alpha particle and the daughter nucleus.

Use conservation of energy and momentum to show that

$$Q = K_\alpha \left(1 + \frac{M_\alpha}{M} \right)$$

where K_α is the kinetic energy of the alpha particle, M_α is the mass of the alpha particle, and M is the mass of the daughter nucleus.

[3]

- (iii) 1. Hence calculate the kinetic energy of the alpha particle emitted in this decay process.

kinetic energy = MeV [2]

2. Comment on your answer in (a)(iii)1. with reference to (a)(i).

..... [1]

- (b) The alpha particle produced in this decay travelled 25 mm in a cloud chamber. Given that, on average, an alpha particle creates 5.0×10^3 ion pairs per mm of track in the cloud chamber, determine the energy required to produce an ion pair.

Energy required to produce an ion pair = J [3]

[Total: 11]