

- 5 An α -particle is travelling in a vacuum towards the centre of a gold nucleus, as illustrated in Fig. 5.1.

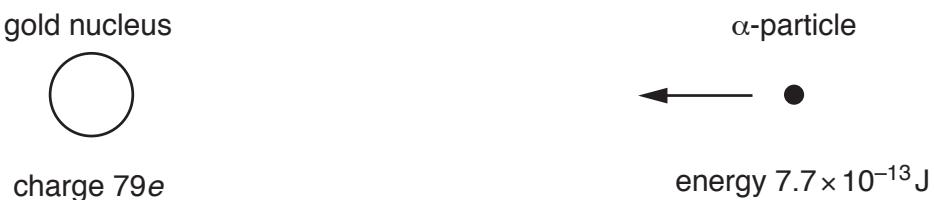


Fig. 5.1

The gold nucleus has charge $79e$.

The gold nucleus and the α -particle may be assumed to behave as point charges.

At a large distance from the gold nucleus, the α -particle has energy $7.7 \times 10^{-13} \text{ J}$.

- (a) The α -particle does not collide with the gold nucleus. Show that the radius of the gold nucleus must be less than $4.7 \times 10^{-14} \text{ m}$.

[3]

- (b) Determine the acceleration of the α -particle for a separation of $4.7 \times 10^{-14} \text{ m}$ between the centres of the gold nucleus and of the α -particle.

$$\text{acceleration} = \dots \text{ m s}^{-2} [3]$$

- (c) In an α -particle scattering experiment, the beam of α -particles is incident on a very thin gold foil.

Suggest why the gold foil must be very thin.

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[Total: 7]