7 **(a)** In the Rutherford α-particle scattering experiment, α-particles are emitted from a source and travel towards a thin gold foil.

(i) An α-particle is deflected through an angle of approximately 45° as it passes near a stationary gold nucleus. On Fig. 7.1, sketch the path of the α-particle as it passes the gold nucleus.

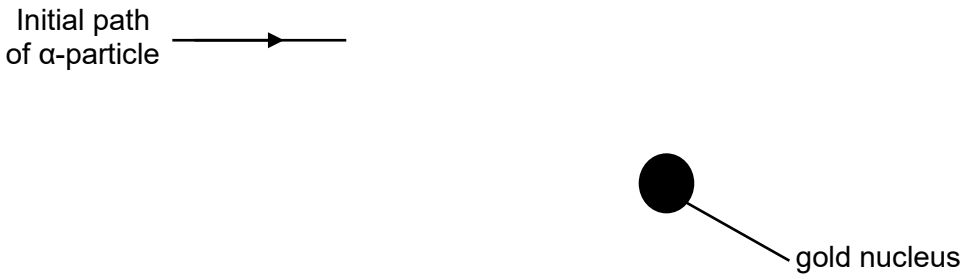

Fig. 7.1

[1]

(ii) Only a small proportion of the α-particles incident on the metal foil are deflected through large angle deflections greater than 90°. Explain the following phenomenon.

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…… [2]

(ii) In the α-particle scattering experiment, a large number of alpha particles are directed at the metal foil.

Explain why a large number of alpha particles is necessary.

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…… [2]

(b) An α-particle with kinetic energy 7.7×10^{-13} J is directed at a stationary gold nucleus ($^{197}_{79}$Au). Determine the minimum separation possible between this α-particle and the gold nucleus.

separation = ... m [3]

(c) The metal foil is changed from gold ($^{197}_{79}$Au) to carbon ($^{12}_{6}$C), while the α-particle energy is kept the same.

State and explain how the number of large-angle deflections would change.

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..... [2]

[Total: 10]