4 **(a)** State and explain the results of the α-particle scattering experiment that suggest the small size of the nucleus compared to that of an atom.

1. .....

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2. .....

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[2]

(b) An α-particle travels, in a vacuum, directly towards a stationary gold nucleus G ($^{197}_{79}$Au), as illustrated in Fig. 4.1.

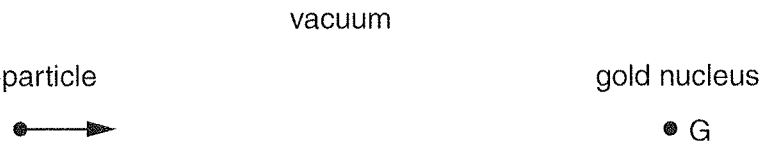

Fig. 4.1

The α-particle has an initial kinetic energy of 4.8 MeV when it is a very long distance from the gold nucleus. The α-particle comes to rest at distance *d* from G.

(i) Show that the initial speed of the α-particle is $1.5 \times 10^7\,\text{m s}^{-1}$.

[2]

(ii) Define *potential* at a point in an electric field.

.....

.....

..... [1]

(iii) Calculate the distance *d*.

d = ...m [3]