5 An α-particle is emitted from a radium nucleus with a kinetic energy of 5.75 MeV.

The α-particle travels in a vacuum directly towards a gold ($^{197}_{79}Au$) nucleus, as illustrated in Fig. 5.1.

Fig. 5.1

(a) Explain why, as the α-particle approaches the gold nucleus, it comes to rest.

……..……
…..

……..……
…..

……..……
……[2]

(b) For the closest approach of the α-particle to the gold nucleus determine

(i) their separation,

separation = …… m [2]

(ii) the magnitude of the force on the α-particle.

force = ………………………………. N [1]

(c) State two assumptions made in the determination in **(b)**.

1. ..……..…………………………………………………………………………………… …...

…...……..…………………………………………………………………………………………..

2. ..……..…………………………………………………………………………………… ….

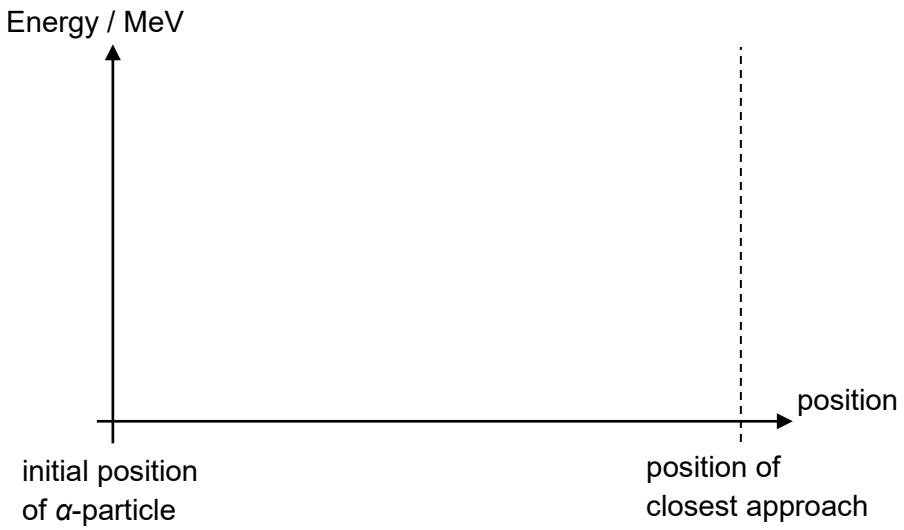
..……..…………………………………………………………………………………………...[2]

(d) The *α*-particle travels from the initial position to the position of closest approach to the gold nucleus.

On Fig. 5.2, sketch the variation with position of

(i) the electric potential energy between the *α*-particle and the gold nucleus, labelled as *EPE*,

(ii) the kinetic energy of the *α*-particle, labelled as *KE*.


Energy / MeV
position
initial position
of α-particle
position of
closest approach

[2]

Fig. 5.2