6 (a) (i) Define *electric potential* at a point.

....

....

....[2]

(ii) State the relationship between electric potential and electric field strength at a point.

....

....

....[2]

(b) Two parallel metal plates A and B are situated a distance 1.2 cm apart in a vacuum, as shown in Fig. 6.1.
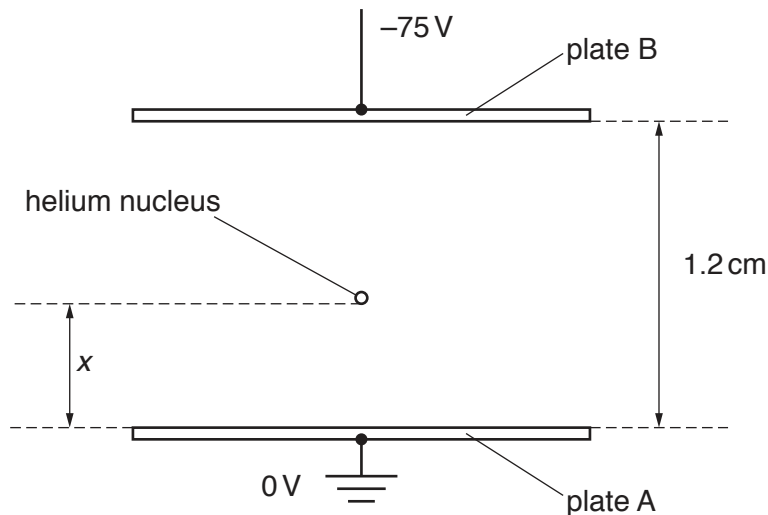

Fig. 6.1

Plate A is earthed and plate B is at a potential of -75 V.

A helium nucleus is situated between the plates, a distance x from plate A.

Initially, the helium nucleus is at rest on plate A where $x = 0$.

(i) The helium nucleus is free to move between the plates. By considering energy changes of the helium nucleus, explain why the speed at which it reaches plate B is independent of the separation of the plates.

....

....

....

....[2]

(ii) As the helium nucleus ($^4_2$He) moves from plate A towards plate B, its distance x from plate A increases.

Calculate the speed of the nucleus after it has moved a distance $x = 0.40\,cm$ from plate A.

speed = ... $m\,s^{-1}$ [3]

[Total: 9]