

- 7 Two vertical metal plates are separated by a distance d in a vacuum, as shown in Fig. 7.1.

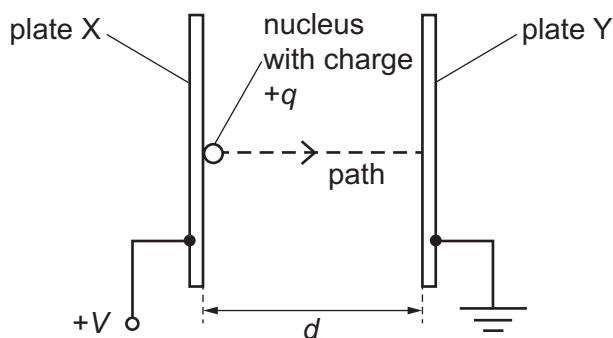


Fig. 7.1 (not to scale)

The potential difference (p.d.) between the plates is V . A nucleus with charge $+q$ is initially at rest on plate X. The nucleus is accelerated by the uniform electric field from plate X along a horizontal path to plate Y.

- (a) State expressions, in terms of some or all of d , q and V , for:

- (i) the magnitude of the electric field strength

electric field strength = [1]

- (ii) the magnitude of the electric force acting on the nucleus

force = [1]

- (iii) the kinetic energy of the nucleus when it reaches plate Y.

kinetic energy = [1]

- (b) State the change, if any, in the kinetic energy of the nucleus on reaching plate Y when the following separate changes are made.

- (i) The distance d is halved, but the p.d. V remains the same.

..... [1]

- (ii) The nucleus is replaced by a different nucleus that is an isotope of the original nucleus with fewer neutrons.

..... [1]

- (c) The nucleus is carbon-14 ($^{14}_6\text{C}$). This nucleus decays to form a new nucleus by releasing a β^- particle and only one other particle of negligible mass.

- (i) Calculate the nucleon number and the proton number of the **new** nucleus.

nucleon number =

proton number =

[1]

- (ii) State the name of the particle of negligible mass.

..... [1]

[Total: 7]