5 A particle of mass m and charge q is in a uniform electric field of strength E. The particle has acceleration a due to the field.

(a) Show that

$$\frac{q}{m} = \frac{a}{E}.$$

[2]

(b) The particle has a charge of $4e$ where e is the elementary charge. The electric field strength is $3.5 \times 10^4\,V\,m^{-1}$. The acceleration of the particle is $1.5 \times 10^{12}\,m\,s^{-2}$.

the expression in **(a)** to show that the mass of the particle is $9.0\,u$.

[2]

(c) The particle is a nucleus. State the number of protons and the number of neutrons in the nucleus.

number of protons = ...

number of neutrons = ...

[1]

(d) A second nucleus that is an isotope of the nucleus in **(c)** is in the same uniform electric field.

State and explain whether the electric field produces, for the two nuclei, the same magnitudes of

(i) force,

....

....[1]

(ii) acceleration.

....

....[1]

[Total: 7]