

- 5 (a) State what is meant by an *electric field*.

.....
..... [1]

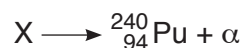
- (b) A particle of mass m and charge q is in a uniform electric field of strength E . The particle has acceleration a due to the field.

Show that

$$a = \frac{Eq}{m}.$$

[2]

- (c) A stationary nucleus X decays by emitting an α -particle to form a nucleus of plutonium, ${}^{240}_{94}\text{Pu}$, as shown.



- (i) Determine the number of protons and the number of neutrons in nucleus X.

number of protons =

number of neutrons =

[2]

- (ii) The total mass of the plutonium nucleus and the α -particle is less than that of nucleus X. Explain this difference in mass.

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

- (iii) The plutonium nucleus and the α -particle are both accelerated by the same uniform electric field.

the expression in (b) to determine the ratio

$$\frac{\text{acceleration of the } \alpha\text{-particle}}{\text{acceleration of the plutonium nucleus}} .$$

ratio = [2]

[Total: 9]