

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

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

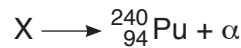
- (b) A particle of mass  $m$  and charge  $q$  is in a uniform electric field of strength  $E$ . The particle has acceleration  $a$  due to the field.

Show that

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

[2]

- (c) A stationary nucleus X decays by emitting an  $\alpha$ -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  $\alpha$ -particle is less than that of nucleus X. Explain this difference in mass.

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

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

Use 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]