

5 Americium-241 decays by emitting α -particles each with kinetic energy of 8.78×10^{-13} J.

- (a) Calculate the speed of an α -particle emitted by americium-241.
mass of an α -particle = 6.64×10^{-27} kg

$$\text{speed} = \dots \text{ms}^{-1} [3]$$

- (b) In a vacuum chamber, there is a magnetic field of magnetic field strength 0.682 T that is directed out of the plane of the page. A sample of americium-241 is placed in this field.

Fig. 5.1 shows that an α -particle initially travels in the plane of the page, perpendicular to the magnetic field. The arrow represents the initial path of an α -particle.

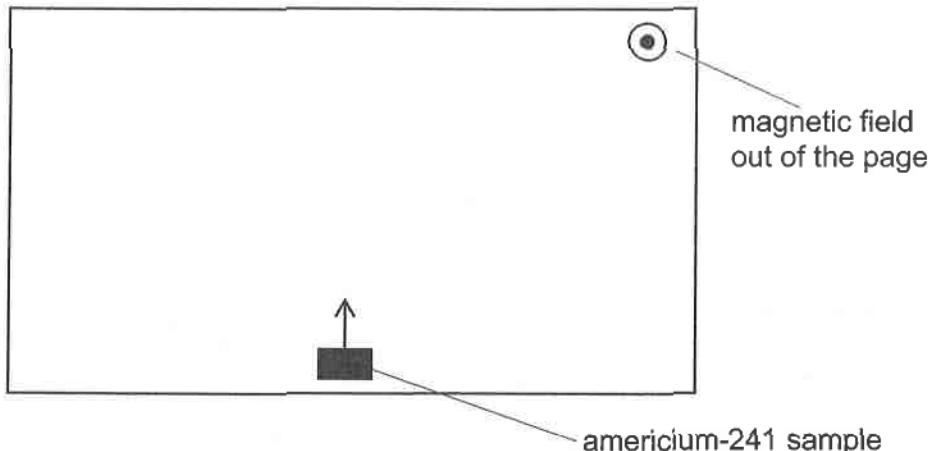


Fig. 5.1

- (i) On Fig. 5.1, sketch the path of the α -particle. [1]
(ii) Calculate the magnitude of the force on the α -particle due to the magnetic field.

$$\text{force} = \dots \text{N} [2]$$



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- (c) State and explain one difference in the path taken by the α -particle after air is allowed to enter the vacuum chamber.

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[2]

- (d) The americium-241 source used in (b) is replaced with a source which emits β -particles.

State and explain **two** differences in the path of a β -particle compared to the path of the α -particle.

1.

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2.

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[4]

[Total: 12]

