

Answer on Question 75491, Physics, Electromagnetism

Question:

A α -particle moves in a circle of radius $5.0 \cdot 10^{-2} \text{ m}$ in magnetic field of 2.0 T . Find the speed of the α -particle.

Solution:

There are two forces that act on the α -particle when it moves in the uniform magnetic field: the magnetic force and the radial force. So, using the Newton's second law of motion we can write:

$$qvB = \frac{mv^2}{r},$$

here, q is the charge of the α -particle, v is the orbital speed of the α -particle, B is the magnetic field, m is the mass of the α -particle, r is the radius of the curvature of α -particle's path.

From this formula, we can find the orbital speed of the α -particle:

$$v = \frac{qBr}{m} = \frac{2 \cdot 1.6 \cdot 10^{-19} \text{ C} \cdot 2.0 \text{ T} \cdot 5.0 \cdot 10^{-2} \text{ m}}{6.644 \cdot 10^{-27} \text{ kg}} = 4.82 \cdot 10^6 \frac{\text{m}}{\text{s}}.$$

Answer:

$$v = 4.82 \cdot 10^6 \frac{\text{m}}{\text{s}}.$$

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