

Answer on question #54317, Physics / Electromagnetism

Question An electron moving at right angles to a uniform magnetic field completes a circular orbit in 10^{-6} sec. calculate the value of magnetic field. please give explanation for the formula that used.

Solution Lorenz force acting on electron will cause centrifugal acceleration. Hence, we can write:

$$qvB = ma_c = m\nu^2r$$

Angular speed is related to period as $\nu = 2\pi/T$. Therefore

$$qvB = m\frac{4\pi^2}{T^2}r$$

$$q\nu rB = m\frac{4\pi^2}{T^2}r$$

$$qB = m\frac{4\pi^2}{T^2}$$

Then the field is

$$B = \frac{m}{q} \frac{4\pi^2}{T^2} = \frac{9.1 \cdot 10^{-31}}{1.6 \cdot 10^{-19}} \frac{4\pi^2}{10^{-12}} \approx 224.3 T$$