

**Answer on question #72807, Physics / Electromagnetism**

A proton with energy 1 MeV move perpendicular to the earth B field of 0.5 gauss or 0.00005T find radius & frequency of orbit?

**Solution:**

$$E = \frac{mv^2}{2} \rightarrow v = \sqrt{\frac{2E}{m}} \text{ -- non-relativistic case, as energy is much less than mass of the proton.}$$

$$\text{According to 2nd Newtons law: } F = ma \rightarrow qBv = \frac{mv^2}{r} \rightarrow r = \frac{mv}{qB} = \frac{m}{qB} \sqrt{\frac{2E}{m}} = \frac{\sqrt{2mE}}{qB}$$

$$r = \frac{\sqrt{2*1.67*10^{-27}*1.6*10^{-13}}}{1.6*10^{-19}*5*10^{-5}} = 2.9 * 10^3 \text{ m -- radius of the orbit}$$

$$\vartheta = \frac{\omega}{2\pi} = \frac{v}{2\pi r} = \frac{1}{r} \sqrt{\frac{E}{2m}} = \frac{1}{2.9*10^3} \sqrt{1.6 * \frac{10^{-13}}{2*1.67*10^{-27}}} = 2.4 * 10^2 \text{ Hz - frequency}$$

**Answer:**

$2.9 * 10^3 \text{ m}$ ,  $2.4 * 10^2 \text{ Hz}$

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