5. The figure shows a region of length 'l' with a uniform magnetic field of 0.3 T in it and a proton entering the region with velocity 4×10^5 ms^{-1} making an angle 60° with the field. If the proton completes 10 revolution by the time it cross the region shown, 'l' is close to (mass of proton $= 1.67 \times 10^{-27}$ kg, charge of the proton $= 1.6 \times 10^{-19}$ C)

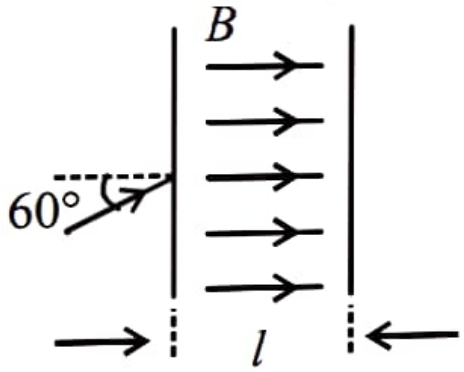
[Sep. 02, 2020 (II)]

(a) 0.11m

(b) 0.88m

(c) 0.44m

(d) 0.22m



5. **(c)** Time period of one revolution of proton, $T = \frac{2\pi m}{qB}$

Here, m = mass of proton

q = charge of proton

B = magnetic field.

Linear distance travelled in one revolution,

$p = T(v \cos\theta)$ (Here, v = velocity of proton)

$\therefore$ Length of region, $l = 10 \times (v\cos\theta)T$

$$\Rightarrow l = 10 \times v\cos 60° \times \frac{2\pi m}{qB}$$

$$\Rightarrow l = \frac{20\pi mv}{qB} = \frac{20 \times 3.14 \times 1.67 \times 10^{-27} \times 4 \times 10^{5}}{1.6 \times 10^{-19} \times 0.3}$$

$$\Rightarrow l = 0.44 \text{ m}$$