For a given length L of wire carrying current I, the number of circular turns producing maximum magnetic moment is:

(A) 1 (B) $\pi^2 \approx 10$ (C) 4 (D) $4\pi^2 \approx 39$

Solution

$M = IA = IN\pi R^2$ where N = number of turns and R = radius

$$N = \frac{L}{2\pi R}$$

$$\therefore R = \frac{L}{2\pi N}$$

Now, $M = IN\pi\left(\frac{L}{2\pi N}\right)^2 = \frac{IL^2}{4\pi N}$

Clearly M is maximum when N = 1

Hence, (A)