

Answer on Question #45824, Physics, Electromagnetism

Question:

A rectangular coil of dimension 20 cm *15 cm lies with its plane parallel to a magnetic field of 0.5 W/m². The coil carrying a current of 10 A experiences a torque of 4.5 Nm in the field. How many loops has the coil?

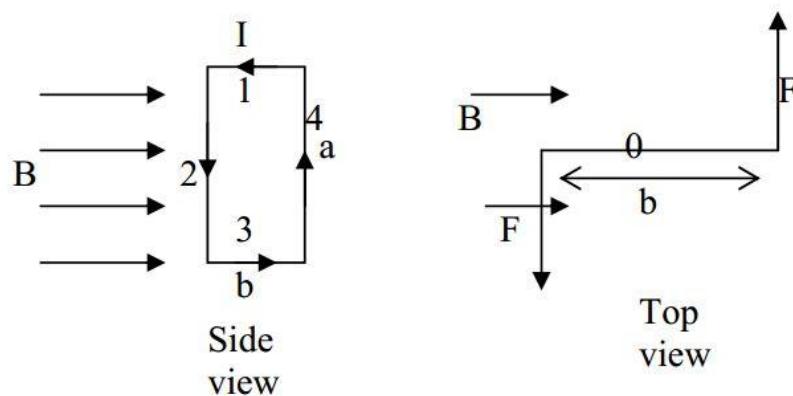
Answer:

Ampère's force law for one side:

$$F = IBa$$

where a is side's length of coil, B is magnetic field, I current.

Considering that we have 2 sides and N loops total force equals:



$$F_{tot} = 2IBaN$$

Therefore torque equals:

$$\tau = 2IBaN \frac{b}{2} = IBNab$$

And number of loops:

$$N = \frac{\tau}{IBab} = 30$$

Answer: 30