

QUES 01

Two identical current-carrying coaxial loops, carry current I in an opposite sense. A simple amperian loop passes through both of them once. Calling the loop as C ,

- a. $\oint_C \vec{B} \cdot d\vec{l} = \pm 2\mu_0 I$
- b. the value of $\oint_C \vec{B} \cdot d\vec{l}$ is independent of sense of C .
- c. there may be a point on C where B and $d\vec{l}$ are perpendicular
- d. B vanishes everywhere on C .

Sol. (b, c)

Key concept: Ampere's law gives another method to calculate the magnetic field due to a given current distribution.



The line integral of the magnetic field \vec{B} around any closed curve is equal to μ_0 times the net current I threading through the area enclosed by the curve, i.e.,

$$\oint_C \vec{B} \cdot d\vec{l} = \mu_0 \Sigma I = \mu_0 (I_1 + I_2 - I_2)$$

Total current crossing the above area is $(I_1 + I_2 + I_2)$. Any current outside the area is not included in the net current. (Outward $\odot \rightarrow +ve$, Inward $\otimes \rightarrow -ve$)

Applying the Ampere's circuital law, we have

$$\oint_C \vec{B} \cdot d\vec{l} = I_{enc} (\mu_0) = 0 \text{ (because the current is in the opposite sense.)}$$

Also, there may be a point on C where B and $d\vec{l}$ are perpendicular and hence,

$$\oint_C \vec{B} \cdot d\vec{l} = 0$$

The value of B does not vanish on various points of C . Thus option (d) is wrong