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(1).

Q #1 Ans:

A Determine the megnatic feild

semicircular piece of wire is 150A.

Sol:

Given:

Radius of semicircular piece of wire = 0.20m

current carried by semicircular piece of wire = 150A

Megnetic field is:

$$B = \frac{\mu_0 N I}{2a}$$

The differential form of biot savart law is:

$$dB = \frac{\mu_0 I}{4\pi} \frac{dl \sin\theta B}{r^2}$$

$$= \frac{\mu_0}{4\pi} I \int \frac{dl \times r}{r^2}$$

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$$= \frac{\mu_0}{4\pi} \frac{I}{r^2} \int dI$$

$$= \frac{\mu_0}{4\pi} \frac{I}{r^2} r\pi$$

$$= \frac{\mu_0 I}{4\pi}$$

$$= \frac{4\pi \times 10^{-7} \, T \cdot m/A \, (150A)}{4(0.2m)}$$

$$\boxed{= 2.4 \times 10^{-4} \, T}$$

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Q#2 Ans:

A circular of radius 5×10^{-2}

circular coil at center.

Sol:

Given:

Radius of circular coil $= 5 \times 10^{-2} m$

current of turns of circular

coil = 40

current carried by coil = 0.25A

Megnetic field:

$$B = \frac{\mu_0 N I}{2a}$$

$$= \frac{4\pi \times 10^{-7} T.m/A (40) 0.25A}{2 \cdot 5.0 \times 10^{-2} m}$$

$$\boxed{B = 1.2 \times 10^{-4} T}$$

Q # 3 Ans:

Compute the magnetic field is closed loop.

Sol:

Given:

$R = 0.05m$

$I = 2 amp$

$\mu_0 = 4\pi \times 10^{-7} N/A^2$

Ampere's law formula is:

$$\oint \vec{B} \cdot \vec{dL} = \mu_0 I$$

in case of long straight wire:

$$\oint \vec{dL} = 2\pi R$$

$$= 2 \times 3.14 \times 0.05$$

$$= 0.314$$

$$B \oint \vec{dL} = \mu_0 I$$

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$$\vec{B} = \frac{\mu_0 I}{2\pi R}$$

Putting values:

$$\vec{B} = \frac{4\pi \times 10^{-7} \times 2}{0.314}$$

$$\boxed{B = 8 \times 10^{-8} \ T}$$

Q # 4 Ans:

a) Find V. E. D and ρv at P(1, 60°, 0.5) in free space. First substituting the given point we find

$$V_P = 279.9V$$

Then

$$E = -\nabla V = \frac{\partial V}{\partial \rho} a_\rho - \frac{1}{\rho} \frac{\partial V}{\partial \varphi} a_\varphi$$

$$= 50 + 150 \sin\varphi] a_\rho - [150 \cos\varphi] a_\varphi$$

evaluate the above at P to find E_P.

$$E_P = \underline{-179.9 a_\rho - 75.0 a_\varphi} \ V/m$$

Now:

$$D = \varepsilon_0 E$$

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$D_\rho = -1.59 a_\rho - 66.4 a_\phi \; nc/m^2$

Then

$$\rho_v = \nabla \cdot D = \left(\frac{1}{\rho}\right)\frac{d}{d\rho}(\rho D_\rho) + \frac{1}{\rho}\frac{\partial D_\phi}{\partial \phi}$$

$$= \left[-\frac{1}{\rho}[(50) + 150 \sin\phi) + \frac{1}{\rho} 150 \sin\phi\right]\varepsilon_0$$

$$= \frac{-50}{\rho}\varepsilon_0 \, c$$

At P

$$\boxed{\rho_v P = -44 p \, c/m^3}$$

Q#5: Ans:

$$emf = \oint E \cdot dL = -\frac{d\varphi}{dt} \int$$

$$\int_{loop\,area} B \cdot a_z \cdot d_a = \frac{d}{dt} (0.3)(4)(6) \cos 500t$$

where the loop normal is chosen as positive a_z so that path integral of E is taken around the positive a_φ direction.

Taking the derivative we find

$$emf = -7.2\,(5000)\,\sin 5000t$$

$$I = \frac{emf}{R}$$

putting values:

$$= \frac{-36000 \sin 5000t}{400 \times 10^3}$$

$$\boxed{I = -90 \sin 5000t \text{ mA}}$$