P3323 quiz8-2
October 12, 2016

1. Ampere's law states that

$$\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$$

Because $\nabla \cdot \mathbf{B} = 0$ we can write $\mathbf{B} = \nabla \times \mathbf{A}$, where $\mathbf{A}$ is the so-called vector potential, since the divergence of a curl is always 0. Ampere's law can thus be written as

$$\nabla^{\mathbf{2}} \mathbf{A} = -\mu_0 \mathbf{J}$$

A) always

B) sometimes

C) never

D) as long as $\nabla \cdot \mathbf{A} = 0$

2. An infinite uniform surface current $\mathbf{K} = k\hat{\mathbf{x}}$ is flowing over the x-y plane. The magnetic field above the plane is

   A) $\mathbf{B} = (\mu_0/2)k\hat{\mathbf{z}}$

   B) $\mathbf{B} = (\mu_0/2)k\hat{\mathbf{x}}$

   C) $\mathbf{B} = (\mu_0/2)k\hat{\mathbf{y}}$

   D) $\mathbf{B} = -(\mu_0/2)k\hat{\mathbf{y}}$

3. An infinite uniform surface current $\mathbf{K} = k\hat{\mathbf{x}}$ is flowing over the x-y plane. The vector potential above the plane is

   A) $\mathbf{A} = -\frac{\mu_0}{2} ky\hat{\mathbf{y}}$

   B) $\mathbf{A} = \frac{\mu_0}{2} kx\hat{\mathbf{y}}$

   C) $\mathbf{A} = \frac{\mu_0}{2} kx\hat{\mathbf{z}}$

   D) $\mathbf{A} = -\frac{\mu_0}{2} ky\hat{\mathbf{z}}$

4. The magnetic dipole moment of a current loop is $\mathbf{m} = I \int d\mathbf{a} = I\mathbf{a}$ where $\mathbf{a}$ is the vector area of the loop. The magnetic dipole moment of a square loop, with sides w that lies in the y-z plane is

   A) $\mathbf{m} = w^2 I \hat{\mathbf{x}}$

   B) $\mathbf{m} = -w^2 I \hat{\mathbf{x}}$

   C) $\mathbf{m} = -2wI \hat{\mathbf{z}}$

   D) $\mathbf{m} = -w^2 I \hat{\mathbf{y}}$

5. The magnetic field on the axis of a current loop with dipole moment $\mathbf{m}$ is

A)

$$\mathbf{B} = \frac{2\mu_0}{4\pi}\frac{\mathbf{m}}{z^3}$$

B)

$$\mathbf{B} = -\frac{2\mu_0}{4\pi}\frac{\mathbf{m}}{z^2}$$

C)

$$\mathbf{B} = \frac{2\mu_0}{4\pi}\frac{\mathbf{m}}{z}$$

D)

$$\mathbf{B} = \frac{2\mu_0}{4\pi}\frac{\mathbf{m}}{z^4}$$