

Magnetic Field and Magnetic effects of current Assignment 1

Question 1:

Find the force on the straight conductor of length .30 m carrying a current of 5 .0 A in the $-\mathbf{k}$ direction where the magnetic Field is given by

$$B=3.5*10^{-3} (\mathbf{i}-\mathbf{j}) \text{ T}$$

- a) $4*10^{-3} \left(\frac{-\mathbf{i}-\mathbf{j}}{\sqrt{2}} \right) N$
- b) $4*10^{-3} \left(\frac{\mathbf{i}-\mathbf{j}}{\sqrt{2}} \right) N$
- c) $7.42*10^{-3} \left(\frac{-\mathbf{i}-\mathbf{j}}{\sqrt{2}} \right) N$
- d) None of the above

Question 2:

A current sheet having current K A/m is placed at in the x-y plane at $z=0$. The direction of current is $-\mathbf{j}$

Find the Magnetic Field at on the z axis

- a) $-\frac{1}{2} \mu_0 K \mathbf{i}$
- b) $\frac{1}{2} \mu_0 K \mathbf{i}$
- c) $\mu_0 K \mathbf{i}$
- d) None of the above

Question 3:

A current sheet where current per unit length is 6.0 A/m and direction is towards $+\mathbf{i}$ is placed at $z=0$ in the x-y plane. A current wire is located at $y=0$ and $z=5$ m .It is placed along the x axis. .Find the current and its direction if Magnetic field is zero at the point P whose location is (0, 0, 2.5) m

- a) 47 A , \mathbf{i}
- b) 47.1 A , $-\mathbf{i}$
- c) 50 A, \mathbf{i}
- d) 50 A, $-\mathbf{i}$

Questions 4 :

A charged particle whose mass is $19.9*10^{-27}$ kg and charge is $1.6*10^{-19}$ C moves with a speed of $3*10^5$ m/s at right angle to a magnetic field of .75 T.

What is the force acting on the charge, centripetal acceleration and radius of the circle in which charged particle moves

- a) $3.6*10^{-14}$ N, $1.81*10^{12}$ m/s², $49.7*10^{-3}$ m

- b) 3.0×10^{-14} N, 1.81×10^{12} m/s², 49.7×10^{-3} m
- c) 3.0×10^{-14} N, 1.8×10^{12} m/s², 49.7×10^{-3} mm
- d) None of the above

Question 5:

Which of the following is true

- A) Magnetic field exerts force only a moving charges.
- B) Electric field exerts force on both stationary and moving charge
- C) Magnetic field exerts force on charge moving parallel to the direction of the field
- D) All of the above

Question 6:

Four Particles P₁(proton) ,P₂(electron) ,P₃(alpha),P₄(neutron) enters a region of constant magnetic field with same velocities. The magnetic field is perpendicular to the velocity

Match the following

Column A

- A) what all particle will not be deflected by the Magnetic field
- B) What all particles will be deflected by the Magnetic Field?
- C) Which particle move in a circular path of maximum radius
- D) Which particle will experience maximum Force?

Column B

- P) P₁
- Q) P₂
- R) P₃
- S) P₄

Question 7:

The force experienced by a particle of charge q moving with a velocity \mathbf{v} in a uniform magnetic field \mathbf{B} is given by

$$\mathbf{F} = q(\mathbf{v} \times \mathbf{B})$$

Statement I: The vectors \mathbf{F} and \mathbf{v} are perpendicular to each other

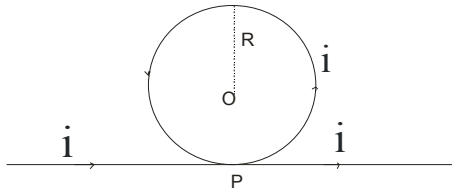
Statement II: The vectors \mathbf{v} and \mathbf{B} can have any angle between them

Statement III: The vectors \mathbf{F} and \mathbf{B} are perpendicular to each other

- a) All the statements are true
- b) Statement I and II are true only
- c) Statement I and III are true only
- d) Statement II and III are true only

Question 8:

A long wire is bent as shown in figure. Find the magnitude and direction of the magnetic field at the center of the circular part if a current of I amp is passed through the wire. The different parts of the wire do not touch each other at Q



- a) $\frac{\mu_0 i}{a} \left(\frac{1}{\pi} + 1 \right)$, directed upwards to the plane of the page
- b) $\frac{\mu_0 i}{2a} \left(\frac{1}{\pi} + 1 \right)$, directed upwards to the plane of the page
- c) $\frac{\mu_0 i}{a} \left(\frac{1}{\pi} - 1 \right)$, directed upwards to the plane of the page
- d) $\frac{\mu_0 i}{2a} \left(\frac{1}{\pi} - 1 \right)$, directed upwards to the plane of the page

Question 9:

A non conducting thin disc of Diameter D charged uniformly over one side with surface density σ rotates about its axis with an angular velocity ω .

What is the magnetic field at the center of the disc

- a) $\frac{\mu_0 \sigma \omega D}{4}$
- b) $\frac{3\mu_0 \sigma \omega D}{4}$
- c) $\frac{\mu_0 \sigma \omega D}{2}$
- d) $\frac{\mu_0 \sigma \omega D}{8}$

Question 10 :

A charged particle moving with constant velocity passes through a space without any change in velocity. Electric Field in the region is given by the

$$\mathbf{E} = a_1 \mathbf{i} + a_2 \mathbf{j} + a_3 \mathbf{k}$$

Magnetic Field in the region is given by the

$$\mathbf{B} = b_1 \mathbf{i} + b_2 \mathbf{j} + b_3 \mathbf{k}$$

Where $a_1, a_2, a_3, b_1, b_2, b_3$ are constant

Which of the following can be true about the region

- a) $a_1 = a_2 = a_3 = b_1 = b_2 = b_3 = 0$
- b) $a_1 = a_2 = a_3 = 0, b_1 \neq 0, b_2 \neq 0, b_3 \neq 0$
- c) $a_1 \neq 0, a_2 \neq 0, a_3 \neq 0, b_1 = b_2 = b_3 = 0$
- d) $a_1 \neq 0, a_2 \neq 0, a_3 \neq 0, b_1 \neq 0, b_2 \neq 0, b_3 \neq 0$

Question 11 :

A charged particle of mass m and charge q moves with a constant velocity along the positive x direction

$$\mathbf{v} = a \mathbf{i}$$

it enter a region of Magnetic field which is directed towards positive z direction from $x=a$ which is given by

$$\mathbf{B} = b \mathbf{k}$$

Find the initial acceleration of the particle

- a) $\mathbf{a} = (-qab/m) \mathbf{i}$
- b) $\mathbf{a} = (-qab/m) \mathbf{j}$
- c) $\mathbf{a} = (-qa/m) \mathbf{j}$
- d) none of these

Question 12.

Find the radius of the circular path which the particle moves

- a) mb/qa
- b) ma/q
- c) mab/q
- d) None of these

Question 13 :

Which of the following is true about the motion of the particle

- a) Force will always be perpendicular to the velocity
- b) The magnitude of the velocity remains constant
- c) velocity vector and magnetic field vector remains perpendicular to each other during the motion
- d) KE of the particle remains constants

Question 14 :

The frequency of the rotation

- a) depends on the value a
- b) depends on the value b
- c) depends on the value a and b both
- d) Does not depend on a and b both

Question 15:

Four circular coil(A,B,C,D) having radius $r, 2r, 3r, 4r$ having numbers of turns $4n, 3n, 2n, n$ and carrying the same same current are there.

Match the Column

Column X

- P) which coil will produce maximum Magnetic induction at the center
- Q) which coil will produce minimum Magnetic induction at the center
- R) Which coil has maximum magnetic moment per turn
- S) Which coil has minimum magnetic moment per turn

P-E Q-H R-E S H

Column Y

E) A

- F) B
- G) C
- H) D

Question 16:

A infinite long thin cylinder of radius R is carrying current I along the axial direction. Which of the following is true

- a) $B = 0$ for $r < R$
- b) $B = k/r$ for $r > R$
- c) $B = kr$ for $r > R$
- d) none of the above

Answer

- 1. c
- 2. a
- 3. a
- 4. a
- 5. A and B
- 6. A-S : B-PQR : C-R : D-R
- 7. a
- 8. d
- 9. a
- 10. a,b,d
- 11. b
- 12. d
- 13. All are true
- 14. b
- 15. P-E : Q-H : R-E :S-H
- 16. a,b