------------------------------------------------------4TH Chapter-----------------------------------------------

1. Formula of the value of the magnetic field, B = ?

Hints: F = Force, q = charge, v = velocity

1. B = F / qv (ans.)
2. B = qv / F
3. B = F / v
4. B = F / q

Prove: If the q charge is moving at a velocity v at right angles to the direction of a magnetic field, then if the charge gains F force, then the single charge will gain F / qv force if it is moving at a single speed. So the value of the magnetic field B will be -

B = F / qv

1. Formula of the force of an electric field, = ?

Hints: F = Force, q = charge, v = velocity, B = magnetic field

1. = × (ans.)
2. = .
3. = /
4. = qvBcosθ

Prove: If the q charge is not moving at right angles to the magnetic field but moving at that angle, then the velocity of the charge along the perpendicular to the direction of the magnetic field i.e. at right angles to the direction of the field will be v sinθ and the value of the magnetic field will be -

B = F / qv sinθ

The value and direction of the magnetic force obtained through the experiment are precisely related to and the magnetic field and the magnetic field B by the following vector equations.

= ×

1. Formula of The Biot-Savart’s Law? (Figure: Physics 2nd Paper by Tapan | Page – 121 | Fg. 4.7)

Hints: µ = Permeability, I = Current flow, dl = r = radius

A. dB = (µ/4π) × (Idl sinθ/r2) (ans.)

B. dB = (µ/2π) × (Idl sinθ/r2)

C. dB = (µ/4π) × (Idl sinθ/r2)

D. dB = (4π/µ) × (Idl sinθ/r2)

Ans: dB = (µ/4π) × (Idl sinθ/r2)

Prove:

If an electric current flows through the short length dl of a conductor, then the value of the magnetic field at a point P at a distance r from the midpoint of that part of the conductor at that angle is -

dB ∝ (Idl sinθ) / r2

or, dB = K (Idl sinθ) / r2 … …(i)

In the SI method, the proportional constant is written,

K = µ0 / 4π

Here, µ0 is a constant number called the magnetic permeability of a vacuum. Its value is,

µ0 = 4π × 10-7 TmA-1

So the form of the Biot-Savart formula in the void is,

dB = (µ0/4π) × (Idl sinθ/r2)

Again, through that magnetic permeability, the form of the Biot-Savart formula is,

dB = (µ/4π) × (Idl sinθ/r2)

1. Formula of the value of the magnetic field, B = ?

Hints: µ0 = Permeability of free space, I = Electric current

A. B = µ0I / 2πa (ans.)

B. B = µ0a / 2πI

C. B = µ0 / 2πaI

D. B = 2πa / µ0I

Ans: B = µ0I / 2πa

Prove:

We know,

B = µ0I / 4π / r2 … …(1)

And cot = - l / a … …(2)

So, -l = a cot

By internalization,

dl = a cosec2

again, cosec = r / a

or, r = a cosec

To determine the extent of addition we get from Equation (2),

When l = , then

And when l = , then

So (1) the equation stands,

B = µ0I / 4π (a cosec2 d) sin / a2cosec2

= µ0I / 4πa sin = - µ0I / 4πa [ cos

= - µ0I / 4πa [ cos π – cos 0 ] = - µ0I / 4πa [ -2 ]

So, B = µ0I / 2πa

1. The magnetic field at the center of the electrically conducting coil, B = ? (Figure: Page 123 | Fig. 4.9)

Hints: µ0 = Permeability of free space, I = Electric current, r = radius

1. B = (ans.)
2. B =
3. B =
4. B = 2 µ 0 I r

Prove:

We know, dB = (µ0/4π) × (Idl sinθ/r2) … …(i)

Here, θ is the included angle of and . Now the value of the magnetic field in P for the whole coil is obtained by summing the equation (i). Since the length of a circular conductor is the length of the circumference of the coil i.e. 2πr, the summation range will be l = 0 to l = 2πr.

So, B = =

Since the distance from all points of the coil to the center P of the circle is equal to r and the angle of any part of the coil including dl and r is always θ = 90 °; So

B = =

= [ l

=

So, B =

1. If the number of coils in the coil is N, then the magnetic field of the circular coil, B = ?

Hints: µ0 = Permeability of free space, I = Electric current, r = radius.

1. B = (ans.)
2. B =
3. B =
4. B =

Prove:

We know, dB = (µ0/4π) × (Idl sinθ/r2) … …(i)

Here, θ is the included angle of and . Now the value of the magnetic field in P for the whole coil is obtained by summing the equation (i). Since the length of a circular conductor is the length of the circumference of the coil i.e. 2πr, the summation range will be l = 0 to l = 2πr.

So, B = =

Since the distance from all points of the coil to the center P of the circle is equal to r and the angle of any part of the coil including dl and r is always θ = 90 °; So

B = =

= [ l

=

So, B =

If the number of horoscopes is N,

B =

1. Lorentz magnetic force, = ?

Hints: q = charge, v = velocity, B = Electric field

1. = (ans.)
2. =
3. =
4. =

Prove:

We know that a dynamic charge in a magnetic field gains a force. This ball is called Lorenz magnetic ball. Suppose a particle with a charge of +q moves at a velocity in a balanced magnetic field . Now the force applied to it by the magnetic field,

=

When the q charge is moving at a speed at a point where electric field and magnetic field exist at the same time, then the force acting on it is -

=

Or,=

This force is called Lorentz magnetic force.

1. Which of the following is the correct relation of electric current with the speed of transmission?

Hints: I = Electric Current, n = Number of charge carriers per unit volume of charge, v = Velocity of charge carrier, q = The charge of each charge carrier

A. I = nAvq (ans.)

B. IA = vq

C. I = nA/vq

D. I = vq/ nA

Ans: I = nAvq

Prove:

1. Formula of a magnetic field in the center of a flowing circular coil, B = ?

Hints: I = Electric current, r = Radius, µ0 = Permeability (space)

A. B = µ0I / 2r (ans.)

B. B = µ0I / r

C. B = µ0r / 2I

D. B = 2rµ0I

Ans: B = µ0I / 2r

Prove: According to the Biot-Savart’s Law we know, a magnetic field in the center of a flowing circular coil, B = µ0I / 2r

1. Which of the following is correct about the relationship between the magnetic moment and the angular momentum for the spin of an electron?

Hints: = Magnetic moment, = angular momentum, e = electron, m = mass of electron

1. = - (ans.)
2. =
3. =
4. = -

Prove:

Angular momentum is created for spin or rotation and a magnetic moment Ms or µs is created for the negative charge of electrons, the direction of which is opposite to the angular momentum caused by spin. The relationship between the magnetic moment and the angular momentum for this spin of the electron is,

= -

1. Correct vector form of Morb ?

Hints:

A. = - e / 2m (ans.)

B. = e / 2m

C. = / 2

D. = - / 2m

Ans: = - e / 2m

Prove:

1. If the radius of the orbit and the velocity of the electron is given, then B = ?

Hints: B = Magnetic field in the center of a flowing circular coil, e = Electron, v = velocity, r = radius

A. B = (µ0 / 4π) × (ev / r2) (ans.)

B. B = (µ0 / 2π) × (ev / r2)

C. B = (µ0 / ev) × (4π / r2)

D. B = (ev / µ0) × 2πr

Ans: B = (µ0 / 4π) × (ev / r2)

Prove:

According to the Biot-Savart’s Law we know, a magnetic field in the center of a flowing circular coil, B = µ0I / 2r

Now if it takes T time for an electron with e charge to rotate once in its orbit then electric current flow, I = e / T

But if the radius of the orbit is r and the velocity of the electron is v then,

T = 2πr / v

thus, I = (e × v) / 2πr

so, B = (µ0 / 2r) × (e / T) = (µ0 / 2r) × (ev / 2πr) or, B = (µ0 / 4π) × (ev / r2)

1. Formula of Magnetic moment, Morb = ?

Hints: I = Electric current flow, L = The angular momentum of an electron, m = mass of electron, h = Planck constant, e = electron, n = number of main orbit

A. Morb = n eh / 4πm (ans.)

B. Morb = (n e / 2m) × h

C. Morb = n eh / 2πm

D. Morb = -n eh / 2πm

Ans: Morb = n eh / 4πm

Prove:

We know, magnetic moment Morb = IA = (ev / 2πr) × πr2 = evr / 2

Or, Morb = (e / 2m) × mvr

But from Bohr's theory the angular momentum of an electron, L = mvr = nh / 2π

So, Morb = (e / 2m) × L = n eh / 4πm

1. Correct vector form of Morb ?

Hints:

A. = - e / 2m (ans.)

B. = e / 2m

C. = / 2

D. = - / 2m

Ans: = - e / 2m

Prove: