Chapter 29: Magnetic Fields

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1 Units and Variables

F_B - force due to a magnetic field, in newtons
q - charge on a particle, in coulombs
v - velocity of a particle, in $\frac{m}{s}$
B - magnetic field, in teslas
I - current on a wire, in amperes
L - length of a wire, in meters
μ - magnetic diapole moment, in Am^2
τ - torque, in Nm
U - potential energy, in joules
r - radius of a circular path, in meters
ω - angular speed of a charged particle, in $\frac{rad}{s}$

2 Equations

Magnetic force exerted on a particle moving through a magnetic field
$F_B = qv \times B$
Magnetic force exerted on a current carrying wire
$F_B = IL \times B$
$F_B = I \int_a^b ds \times B$
F_B on a closed loop wire is 0
Magnetic diapole moment of a current loop
$\mu = IA$
Torque on a magnetic diapole moment
$\tau = \mu \times B$
Potential energy of a system of a magnetic diapole moment
$U = -\mu \cdot B$
$U_{max} = -\mu B$ when μ points in the same direction as B
$U_{min} = +\mu B$ when μ points in the opposite direction of B
Radius of circular motion of a charged particle
$r = \frac{mv}{qB}$
Angular speed of a charged particle
$\omega = \frac{v}{r} = \frac{qB}{m}$