PHYS 1512: Week 4 (Review Week)

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Equations

$$F = v|q|Bsin(\theta) = |q|(v \times B) \quad \text{(Magnetic force on a particle)} \tag{1}$$

$$r = \frac{mv}{|q|B} \quad \text{(radius of particle in B-Field)} \tag{2}$$

$$B = \frac{\mu_o I}{2\pi r} \quad \text{(Magnetic Field of current carrying wire)} \tag{3}$$

$$\mu_o = 4\pi * 10^{-7} \frac{Vs}{Am}$$

Relevant concepts

-how magnetic fields are produced

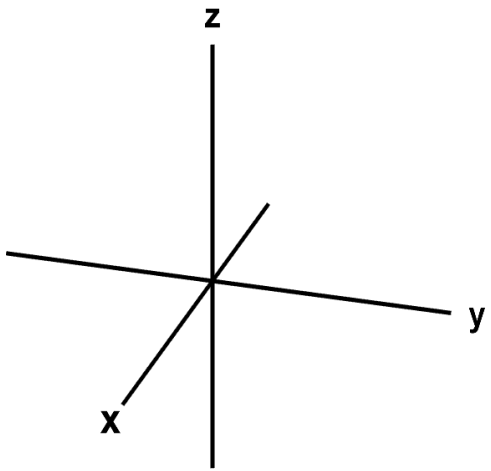
-Into the page/out of the page notation

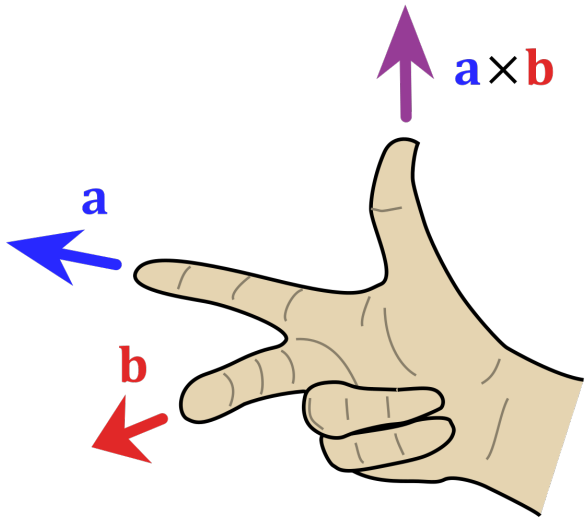
-Magnetic Poles and how they interact

-Right Hand Rule

Figure: "Magnets, how do they work?"

Relevant concepts





Question #1

Fundamentals

At a location near the equator, the earth's magnetic field is horizontal and points north. An electron is moving vertically upward from the surface of earth. What is the direction of the magnetic force that acts on the electron?

a)North
b)East
c)South
d)West
e)The magnetic force is zero

Question #2

Fundamentals

Two particles are found to be within some volume. Particle 1 is at rest while Particle 2 is moving with a speed v.

1) Which particle produces both a B-Field and E-Field?

2) If Particle 2 is a **positive** charge moving in the +x-direction and encounters a uniform B-Field in the +z-direction, which direction does it experience a magnetic force upon interaction?

3) Repeat part 2 but let particle 2 be **negative**.

4) Repeat parts 2 and 3 but now particle 2 is moving in the +z direction.

Question #3

Motion in B-Field

A particle of charge +q is moving with a velocity v. It suddenly encounters a uniform B-Field that is shaped like a small box pointing into the page.

1) At the moment it encounters the B-Field what direction is the magnetic force?

2)Draw the path of the path the particle would take. Your picture should include when the particle exits the B-Field.

3) If the B-Field was instead everywhere and still pointing into the page, what would the path of +q be? Repeat this if +q was now -q.

4) What would the radius of the path taken in part 3 if B=0.2T, m=$3 * 10^{-18}$kg, q=$9nC$ and the centripetal acceleration is $6 * 10^9 \frac{m}{s^2}$?

Question #4

Current carrying wire

A wire carries a current of 2A in the +z direction and produces a magnetic field parallel to the x-y plane as shown in the picture below.
1) If a spark shoots an electron parallel to the x-y plane (i.e. in the direction of the "r" arrow in the picture) what direction does it experience a magnetic force?
2) What is the magnitude of this force if the electron doesn't experience a noticeable magnetic effect until it is r= 0.2m away from the wire while the electron has a velocity of $100\frac{m}{s}$?