

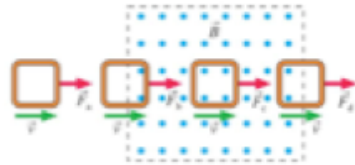
Problem #1: Multiple choice (24 points – 2 points per question)

What is the *shape* of the trajectory that a charged particle follows in a uniform magnetic field?

Assume that the particle is injected at an arbitrary angle to the magnetic field.

- A. Helix
- B. Parabola
- C. Circle
- D. Ellipse
- E. Hyperbola

A

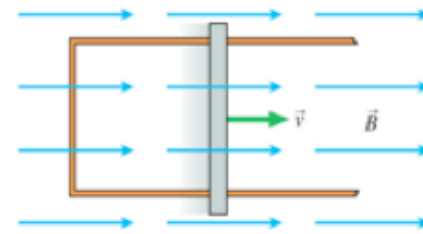


A square loop of copper wire is pulled through a region of magnetic field. Rank in order, from strongest to weakest, the pulling forces F_a , F_b , F_c and F_d that must be applied to keep the loop moving at constant speed.

- A. $F_b = F_d > F_a = F_c$
- B. $F_c > F_b = F_d > F_a$
- C. $F_c > F_d > F_b > F_a$
- D. $F_d > F_b > F_a = F_c$
- E. $F_d > F_c > F_b > F_a$

A

Name: _____

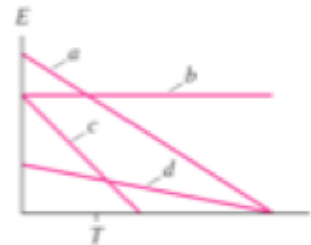


Is there an induced current in this circuit? If so, what is its direction?

- A. No
- B. Yes, clockwise
- C. Yes, counterclockwise

A

The electric field in four identical capacitors is shown as a function of time. Rank in order, from largest to smallest, the magnetic field strength at the outer edge of the capacitor at time T . (5)

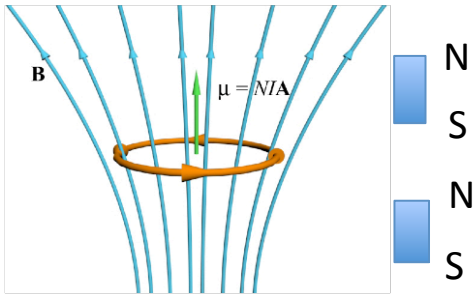


E

- A. $B_a = B_b > B_c = B_d$
- B. $B_d > B_c > B_a = B_b$
- C. $B_a > B_b > B_c > B_d$
- D. $B_a = B_b > B_c > B_d$
- E. $B_c > B_a > B_d > B_b$

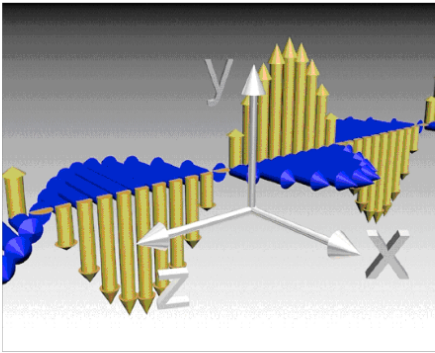
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Dipole in Field



The current carrying coil above will move

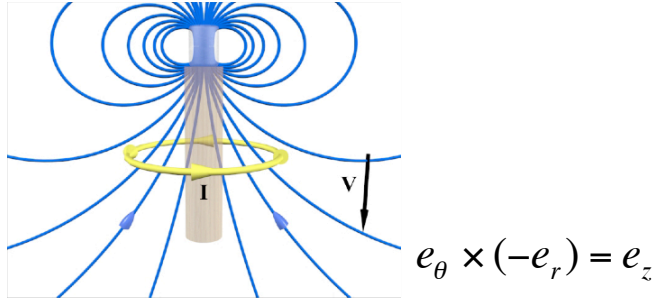
1. upwards 2
2. downwards
3. stay where it is because the total force is zero



The graph shows the E (yellow) and B (blue) fields of a plane wave. This wave is propagating in the

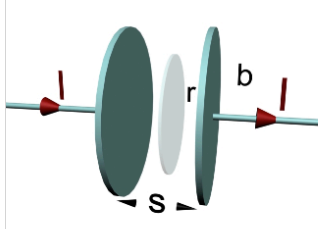
1. +x direction
2. -x direction
3. +z direction
4. -z direction 4
5. Don't have a clue

$$e_y \times e_x = -e_z$$



When the coil is below the magnet and moving downwards. This induces a current as pictured. The $I ds \times B$ force on the coil is

1. Upwards 1
2. Downwards
3. Zero



Consider the above circular capacitor, and the Amperian loop (radius r) in the plane midway between the plates. When the capacitor is charging, the line integral of the magnetic field around the Amperian loop is

1. Zero: No current crosses the surface spanning the Amperian loop
2. Zero: The magnetic field is perpendicular to the Amperian Loop
3. Non-zero: An electric current flows between the capacitor plates
4. Non-zero: There is time changing electric flux on the surface spanning the Amperian Loop 4

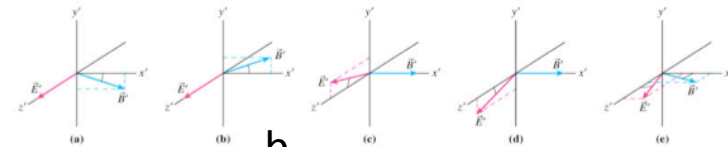
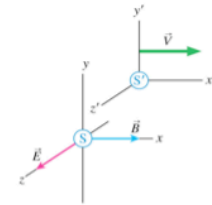
The amplitude of the oscillating electric field at your cell phone is $4.0 \mu\text{V/m}$ when you are 10 km east of the broadcast antenna. What is the electric field amplitude when you are 20 km east of the antenna?

- A. $4.0 \mu\text{V/m}$
- B. $2.0 \mu\text{V/m}$
- C. $1.0 \mu\text{V/m}$
- D. There's not enough information to tell.

B

Name: _____

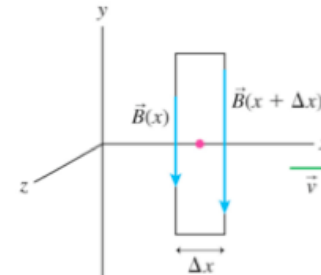
Which diagram shows the fields in frame S' ?



b

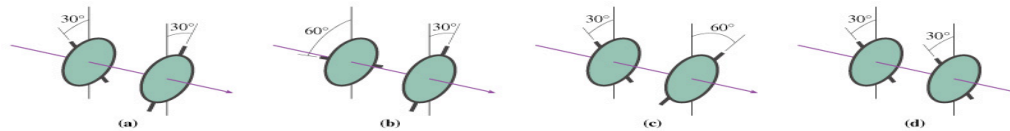
Same E field but $B' = B - v \times E$

An electromagnetic wave is propagating in the positive x-direction. At this instant of time, what is the direction of the electric field E at the center of the rectangle? (5)



- A. In the positive x-direction
- B. In the negative x-direction
- C. In the positive z-direction
- D. In the negative z-direction
- E. In the positive y-direction

C



C

Unpolarized light of equal intensity is incident on four pairs of polarizing filters. Rank in order, from largest to smallest, the intensities I_a to I_d transmitted through the second polarizer of each pair.

- A. $I_a = I_d > I_b = I_c$
- B. $I_b = I_c > I_a = I_d$
- C. $I_d > I_a > I_b = I_c$
- D. $I_b = I_c > I_a > I_d$
- E. $I_d > I_a > I_b > I_c$