PHYSICS 1B QUIZ #4 FALL QUARTER 2009 **Form A**

YOUR NAME _____ (PRINT NEATLY!)

YOUR PID NUMBER_____ (PRINT NEATLY!)

INSTRUCTIONS: THERE ARE 10 QUESTIONS ON THIS QUIZ. PLEASE FILL IN THE SCANTRON FORM USING A NUMBER 2 PENCIL. ***Note: Any confirmed case of cheating will result in an "F" grade in Physics 1B and referral to the dean for disciplinary action*.**

1. Two parallel conductors each of 0.50 m length, separated by 5.0×10^{-3} m and carrying 3.0 A in opposite directions, will experience what type and magnitude of mutual force? (magnetic permeability in empty space $\mu_0 = 4\pi \times 10^{-7}$ T.m/A)

$$\frac{F}{l} = \frac{\mu_0 I_1 I_2}{2\pi d} = \frac{4\pi E-7 \times 3 \times 3}{2\pi \times 5E-3} = 3.6E-4$$

$$3.6E-4 \times 0.5 = 1.8E-4\ N, repulsive$$

   a. attractive, 0.06×1^{-4} N
   b. repulsive, 0.60×10^{-4} N
   c. attractive, 1.8×10^{-4} N
   d. repulsive, 1.8×10^{-4} N

2. A proton is released such that it has an initial speed of 4.0×10^5 m/s from left to right across the page. A magnetic field of 1.2 T is present at an angle of 30° to the horizontal direction (or positive *x* axis). What is the magnitude of the force experienced by the proton? ($q_p = 1.6 \times 10^{-19}$ C)

$$F = qvBsin\theta = 1.6E-19 \times 4E5 \times 1.2 \times sin30 = 3.8E-14N$$

   a. 4.8×1^{-25} N
   b. 1.3×10^{-19} N
   c. 3.8×10^{-14} N
   d. 7.5×10^{3} N

3. A circular loop carrying a current of 1.0 A is oriented in a magnetic field of 0.35 T. The loop has an area of 0.24 m^2 and is mounted on an axis, perpendicular to the magnetic field, which allows the loop to rotate. What is the torque on the loop when its plane is oriented at a 25° angle to the field?

$$\tau = BIAsin\theta = 0.35 \times 1 \times 0.24 \times \sin(65) = 0.076\ N.m$$

   a. 4.6 N.m
   b. 0.076 N.m
   c. 0.051 N.m
   d. 0.010 N.m

4. A superconducting wire carries a current of 10^4 A. Find the magnetic field at a distance of 1.0 m from the wire. ($\mu_0 = 4\pi \times 10^{-7}$ T.m/A)

$$B = \frac{\mu_0 I}{2\pi r} = \frac{4\pi E - 7 \times 10^4}{2\pi \times 1} = 2E - 3T$$

a. 2×10^{-3} T
b. 8×10^{-3} T
c. 1.6×10^{-2} T
d. 3.2×10^{-2} T

5. An incredible amount of electrical energy passes down the funnel of a large tornado every second. Measurements taken in Oklahoma at a distance of 9.00 km from a large tornado showed an almost constant magnetic field of 1.50×10^{-8} T associated with the tornado. What was the average current going down the funnel? ($\mu_0 = 4\pi \times 10^{-7}$ T.m/A)

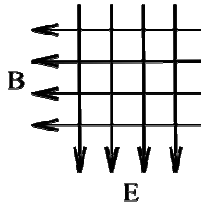
$$B = \frac{\mu_0 I}{2\pi r} => I = \frac{B2\pi r}{\mu_0} = 675\ A$$

a. 450 A
b. 675 A
c. 950 A
d. 1 500 A

6. An electron moves through a region of crossed electric and magnetic fields. The electric field E = 2 000 V/m and is directed straight down. The magnetic field B = 0.80 T and is directed to the left. For what velocity v of the electron into the paper will the electric force exactly cancel the magnetic force?

$$F = Eq = qvB => v = \frac{E}{B} = \frac{2000}{0.8} = 2500\ m/s$$

a. 2 500 m/s
b. 4 000 m/s
c. 5 000 m/s
d. 8 000 m/s



7. At the Fermilab accelerator in Weston, Illinois, singly-charged ions with momentum 4.8×10^{-16} kg.m/s are held in a circular orbit of radius 1 km by an upward magnetic field. What B field must be used to maintain the ions in this orbit? ($q_{ion} = 1.6 \times 10^{-19}$ C)

$$F = m\frac{v^2}{r} = qvB => B = \frac{mv}{qr} = \frac{P}{qr} = 3T$$

a. 1 T
b. 2 T
c. 3 T
d. 4 T

8. A proton and a deuteron are moving with equal velocities perpendicular to a uniform magnetic field. A deuteron has the same charge as the proton but has twice its mass. The ratio of the acceleration of the proton to that of the deuteron is

$$F = ma, \qquad 1 = \frac{ma(proton)}{2ma(deuteron)} => \frac{a(proton)}{a(deutron)} = 2$$

a. 2.0
b. 1.0
c. 0.5
d. There is no acceleration in this case.

9. A proton with initial kinetic energy E is moving in circular motion in a uniform magnetic field. When it has completed one eighth of a revolution, what is its kinetic energy?

The proton doesn't lose or gain any energy as a result the kinetic energy is the same, E.

a. 1.4 E
b. 0.71 E
c. E
d. The value is not given.

10. Two insulated current-carrying straight wires of equal length are arranged in the lab so that Wire A carries a current northward and Wire B carries a current eastward, the wires crossing at their midpoints separated only by their insulation. Which of the following statements are true?

Since the wires are crossing at the midpoints then the force on each side of wires is equal and opposite direction as a result the net force on each wire is zero.

a. The net force on Wire B is southward.
b. The net force on Wire A is westward.
c. There are no forces in this situation.
d. There are forces, but the net force on each wire is zero.