General Physics II
2009 Fall
Prof Richard Ignace

HOMEWORK #3

- *This homework is due by the beginning of class on October 15. It covers material in chapters 19 and 20.*
- *You will need a calculator and lots of scrap paper.*
- *Answers are to be recorded on a scantron that you will turn in. You may keep the questions (i.e., these sheets).*
- *You may (should) use your book. You may even work with other students. However, you should not copy the answers of other students. Since the exams are multiple choice, the homeworks are also exam prep, and so you need to be able to work these problems yourself. If you do not apply yourself to the homework and do your own work, you are not likely to perform well on the exams.*

1. An electron which moves with a speed of 3.0×10^4 m/s parallel to a uniform magnetic field of 0.40 T experiences a force of what magnitude? ($e = 1.6 \times 10^{-19}$ C)

   a. 4.8×10^{-14} N
   b. 1.9×10^{-15} N
   c. 2.2×10^{-24} N
   d. zero

2. Assume that a uniform magnetic field is directed into this page. If an electron is released with an initial velocity directed from the bottom edge to the top edge of the page, which of the following describes the direction of the resultant force acting on the electron?

   a. out of the page
   b. to the right
   c. to the left
   d. into the page

3. A current-carrying wire of length 50 cm is positioned perpendicular to a uniform magnetic field. If the current is 10.0 A and it is determined that there is a resultant force of 3.0 N on the wire due to the interaction of the current and field, what is the magnetic field strength?

   a. 0.60 T
   b. 1.5 T
   c. 1.8×10^{-3} T
   d. 6.7×10^{-3} T

4. 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?

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

5. A deuteron, with the same charge but twice the mass of a proton, moves with a speed of 3.0×10^5 m/s perpendicular to a uniform magnetic field of 0.20 T. Which of the paths described below would it follow? ($q_p = 1.6 \times 10^{-19}$ C and $m_d = 3.34 \times 10^{-27}$ kg)

   a. a straight line path
   b. a circular path of 1.6 cm radius
   c. a circular path of 3.1 cm radius
   d. a circular path of 0.78 cm radius

6. 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)

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

7. A solenoid with 500 turns, 0.10 m long, carrying a current of 4.0 A and with a radius of 10^{-2} m will have what strength magnetic field at its center? (magnetic permeability in empty space $\mu_0 = 4\pi \times 10^{-7}$ T·m/A)

   a. 31×10^{-4} T
   b. 62×10^{-4} T
   c. 125×10^{-4} T
   d. 250×10^{-4} T

8. A uniform 4.5-T magnetic field passes through the plane of a wire loop 0.10 m^2 in area. What flux passes through the loop when the direction of the 4.5-T field is at a 30° angle to the normal of the loop plane?

   a. 5.0 T·m^2
   b. 0.52 T·m^2
   c. 0.39 T·m^2
   d. 0.225 T·m^2

9. A planar loop consisting of four turns of wire, each of which encloses 200 cm^2, is oriented perpendicularly to a magnetic field that increases uniformly in magnitude from 10 mT to 25 mT in a time of 5.0 ms. What is the resulting induced current in the coil if the resistance of the coil is 5.0 Ω?

    a. 60 mA
    b. 12 mA
    c. 0.24 mA
    d. 48 mA

10. A large jetliner with a wingspan of 40 m flies horizontally and due north at a speed of 300 m/s in a region where the magnetic field of the earth is 60 μT directed 50° below the horizontal. What is the magnitude of the induced emf between the ends of the wing?

    a. 250 mV
    b. 350 mV
    c. 550 mV
    d. 750 mV

11. What is the self-inductance in a coil that experiences a 3.0-V induced emf when the current is changing at a rate of 110 A/s?

    a. 83 mH
    b. 45 mH
    c. 37 mH
    d. 27 mH

12. A series circuit contains a 12-V battery, a 2.0-Ω resistor, and a 3.0-mH inductor. If the switch to the battery is closed at $t = 0$, find the time required for the current in the circuit to reach 63% of its final value.

    a. 1.5 ms
    b. 3.0 ms
    c. 4.0 ms
    d. 5.0 ms

13. A 12-V battery is connected in series with a switch, 6.0-Ω resistor and coil. What energy is stored in the coil when the current is 2.0 A? The time constant is 4.0×10^{-4} s.

    a. 4.8×10^{-3} J
    b. 9.6×10^{-3} J
    c. 14×10^{-3} J
    d. 29×10^{-3} J