Instructor(s): *Z. Qiu*

PHYSICS DEPARTMENT

PHY 2005, Spring, 2015 EXAM II February 25, 2015

Name (print, last first): _____ Signature: _____

*On my honor, I have neither given nor received unauthorized aid on this examination.*

**YOUR TEST NUMBER IS THE 5-DIGIT NUMBER AT THE TOP OF EACH PAGE.**

(1) **Code your test number on your answer sheet (use lines 76–80 on the answer sheet for the 5-digit number)**. Code your name on your answer sheet. **DARKEN CIRCLES COMPLETELY**. Code your UFID number on your answer sheet.
(2) Print your name on this sheet and sign it also.
(3) Do all scratch work anywhere on this exam that you like. **Circle your answers on the test form.** At the end of the test, this exam printout is to be turned in. No credit will be given without both answer sheet and printout.
(4) **Blacken the circle of your intended answer completely, using a #2 pencil or blue or black ink**. Do not make any stray marks or some answers may be counted as incorrect.
(5) **The answers are rounded off. Choose the closest to exact. There is no penalty for guessing. If you believe that no listed answer is correct, leave the form blank.**
(6) Hand in the answer sheet separately.

Physical Constants:

| | | |
|---|---|---|
| $g = 9.8$ m/s$^2$ | $m_e = 9.11 \times 10^{-31}$ kg | $m_p = 1.67 \times 10^{27}$ kg |
| $e = 1.6 \times 10^{-19}$ C | constant $k$ in Coulomb's Law: $k = 8.99 \times 10^9$ Nm$^2$/C$^2$ | |
| $\mu_o = 4\pi \times 10^{-7}$ N/A$^2$ | $\varepsilon_o = 8.85 \times 10^{-12}$ C$^2$/Nm$^2$ | |

1. A solenoid with 250 turns, 0.20 m long, carrying a current of 4.0 A and with a radius of 2.0 cm will have what strength magnetic field at its center? (magnetic permeability in empty space $\mu_0 = 4\pi \times 10^{-7}$T·m/A)

   (1) $6.3 \times 10^{-3}$T (2) $8.0 \times 10^{-4}$T (3) $1.56 \times 10^{-3}$T (4) $1.25 \times 10^{-2}$T (5) $4.3 \times 10^{-3}$T

2. A electron is released such that it has an initial speed of $4.0 \times 10^5$m/s from left to right across the page. A magnetic field of 2.8 T is present at an angle of 25° above the horizontal direction (or positive $x$ axis). What are the magnitude of the force experienced by the electron and direction of the force? ($q_p = -1.6 \times 10^{-19}$C)

   (1) $7.6 \times 10^{-14}$ N and into the page
   (2) $3.8 \times 10^{-14}$ N and into the page
   (3) $7.6 \times 10^{-14}$ N and out of the page
   (4) $3.8 \times 10^{-14}$ N and out of the page
   (5) $9.2 \times 10^{-4}$ N and to the right

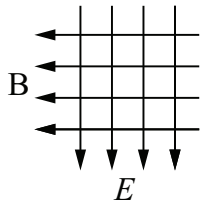
3. Two singly ionized isotopes, A and B, of the same element move with the same speed perpendicular to a uniform magnetic field. Isotope A has a mass of 10 u (u: atomic mass units) and follows a path of radius 5.35 cm while isotope B moves along a path 12.84 cm in radius. What is the mass of isotope B (in u)?

   (1) 24 (2) 12 (3) 20 (4) 30 (5) 16

4. Two parallel wires lie 5 cm apart on a tabletop. They carry 3 A current in each wire in the same direction. Now the current has increased to 6 A in each wire. The magnetic force acting on each wire

   (1) is 4 times larger than that with 3 A current in each wire.
   (2) is 2 times larger than that with 3 A current in each wire.
   (3) is exactly same as that with 3 A current in each wire.
   (4) is now in the opposite direction.
   (5) is 8 times larger than that with 3 A current and in the opposite direction.

5. An electron moves through a region of crossed electric and magnetic fields. The electric field $E = 2000$ V/m and is directed straight down. The magnetic field is directed to the left. If the electron moving into the paper with a speed of 7 km/s without being deflected, what is the magnitude of the magnetic field (in T)?




(1) 0.29 (2) 0.84 (3) 0.16 (4) 0.47 (5) 255

6. A square coil, enclosing an area with sides 8.0 cm long, is wrapped with 2500 turns of wire. A uniform magnetic field perpendicular to its plane is turned on and increases to 1.5 T during an interval of 3.0 s. What average voltage is induced in the coil?

(1) 8.0 V (2) 4.0 V (3) 12.0 V (4) 16.0 V (5) 2.0 V

7. A 300-turn circular coil with an area of 0.15 $m^2$ is mounted on a rotating frame, which turns at a rate of 30.0 rad/s in the presence of a 0.10-T uniform magnetic field that is perpendicular to the axis of rotation. What is the instantaneous emf in the coil at the moment that the normal to its plane is parallel to the field?

(1) zero (2) 125 V (3) 33.75 V (4) 270 V (5) 67.5 V

8. A flat coil of wire consisting of 40 turns, each with an area of 25 $cm^2$, is positioned perpendicularly to a uniform magnetic field that increases its magnitude at a constant rate from 1.0 T to 5.0 T in 4.0 s. If the coil has a total resistance of 0.40Ω, what is the magnitude of the induced current?

(1) 250 mA (2) 70 mA (3) 35 mA (4) 400 mA (5) 110 mA

9. In the inductor of a 120-Hz AC series circuit, the peak voltage precedes the peak current in each cycle by what time interval?

(1) $2.1 \times 10^{-3}$s (2) $4.5 \times 10^{-3}$s (3) $8.3 \times 10^{-3}$s (4) $1.7 \times 10^{-3}$s (5) $3.4 \times 10^{-3}$s

10. An AC series circuit has 12.0Ω resistance, 15.00Ω inductive reactance and 10.00Ω capacitive reactance. If an AC with maximum emf of 170 V is applied, what is the effective (rms) current value?

(1) 9.25 A (2) 5.3 A (3) 10.8 A (4) 26.0 A (5) 16.9 A

11. Find the resonant frequency for a series $RLC$ circuit where $R = 50.0\Omega$, $C = 10.0\mu$F, and $L = 4.0$ mH.

(1) 796 Hz (2) 507 Hz (3) 1.59 kHz (4) 5.00 kHz (5) 1.29 kHz