Instructor(s):

PHYSICS DEPARTMENT

PHY 2005, Spring 2010 EXAM I February 10, 2010

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.
(6) **Hand in the answer sheet separately.**

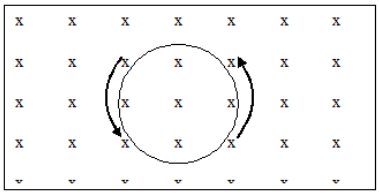
Physical Constants:

$g = 9.8$ 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: $k = 9 \times 10^9$ 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 sodium ion ($q = +e, m = 23 \times 10^{-27}$ kg) is moving with speed 3×10^4 m/s perpendicular to a magnetic field. What must be the magnitude of the field if the particle is to follow a circle with 0.4 m radius? (in tesla)

   (1) 0.0108 (2) 0.036 (3) 0.09 (4) 0.36 (5) 0.72

2. A circular conducting loop is lying on the plane perpendicular to a uniform magnetic field as shown in the figure below. A current is made to flow in the direction as shown in the figure. The magnetic field exerts on the loop



   (1) no net force and no net torque.
   (2) net force only.
   (3) net torque only.
   (4) net force and net torque.
   (5) not enough information.

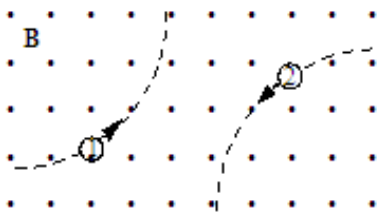
3. Two coils (#1 and #2) made out of the same wire are in a uniform magnetic field with the coil axis aligned in the field direction. Coil #1 has 10 turns of loop with a radius of 5 cm and coil #2 has 5 turns with a radius of 10 cm. Now the field strength is doubled in 2 s. What is the ratio of the emf induced in each coil ($emf_1 : emf_2$).

   (1) 1:2 (2) 1:1 (3) 2:1 (4) 1:4 (5) not enough information

4. A 100 μF capacitor is charged to have 3 V potential difference across the capacitor. The charge stored in the capacitor is discharged through 100 kOhm resistor for 10 s. How much charge is left in the capacitor? (in C)

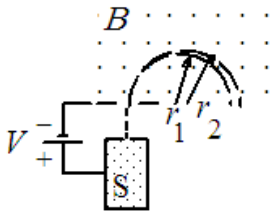
   (1) 1.11×10^{-4} (2) 3×10^{-4} (3) 0 (4) not enough information (5) 1.6×10^{-19}

5. Two particles move through a uniform magnetic field that is directed out of the plane of the page. The figure shows the paths taken by the two particles as they move through the field. The particles are not subject to any other forces or fields. Which one of the following statements concerning these particles is true?



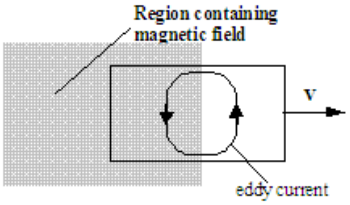
   (1) Particle 1 is negatively charged; 2 is negative.
   (2) The particles may both be neutral.
   (3) Particle 1 is positively charged; 2 is negative.
   (4) Particle 1 is positively charged; 2 is positive.
   (5) Particle 1 is negatively charged; 2 is positive.

6. A mass spectrometer is used to separate two isotopes of uranium with masses m_1 and m_2 where $m_2 > m_1$. The two types of uranium atom exit an ion source S with the same charge of +e and are accelerated through a potential difference V. The charged atoms then enter a constant, uniform magnetic field B as shown. If $r_1 = 0.5049$ m and $r_2 = 0.5081$ m, what is the value of the ratio m_1/m_2?



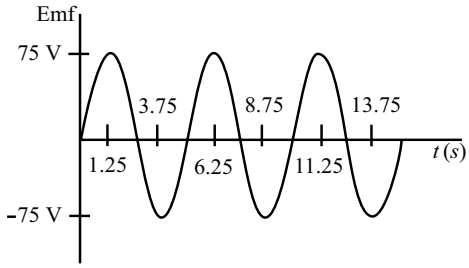
(1) 0.9874 (2) 0.9984 (3) 0.9749 (4) 0.9937 (5) 0.9812

7. A sheet of copper is pulled at constant velocity v from a region that contains a uniform magnetic field. At the instant shown in the figure, the sheet is partially in and partially out of the field. The induced emf in the sheet leads to the eddy current shown. Which one of the following statements concerning the direction of the magnetic field is true?



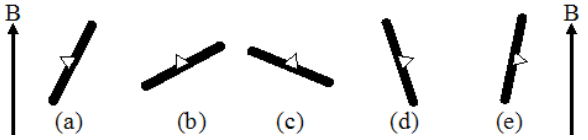
(1) The magnetic field points out of the paper.
(2) The magnetic field points to the right.
(3) The magnetic field points to the left.
(4) The magnetic field points into the paper.
(5) The direction of the magnetic field cannot be determined from the information given.

8. A single conducting loop with an area of 2.0 m^2 rotates in a uniform magnetic field so that the induced emf has a sinusoidal time dependence as shown. What is the angular frequency that the loop rotates with (in rad/s) and what is the rms amplitude (in V)?



(1) 1.26 rad/s and 53.0 V
(2) 5.0 rad/s and 37.5 V
(3) 72.0 rad/s and 37.5 V
(4) 5.0 rad/s and 106.1 V
(5) 72.0 rad/s and 75.0 V

9. A single circular loop of an AC generator is rotating with a constant speed. The following figure shows the several consecutive positions of the coil relative to the magnetic field during the rotation. The polarity of the induced EMF changes between _____ . The small triangle on the loop indicates the top of the loop.



(1) (b) and (c) (2) (d) and (e) (3) (a) and (b) (4) (c) and (d) (5) none

10. A laser has a power of 3×10^{-3} W, and the radius of the beam is 1 cm = 10^{-2} m. Which is closest to the intensity of the laser light as it leaves the end of the laser?

(1) 10 W/ m^2 (2) 1 W/ m^2 (3) 0.3 W/ m^2 (4) 0.01 W/ m^2 (5) 0.003 W/ m^2

11. Which of the following is not a primary color of *light*? Note: "X" is *not* the correct answer.

(1) yellow (2) red (3) blue (4) green (5) X

12. How much flux does a bulb emit if its mean spherical luminous intensity is 40 cd?

(1) 502 (2) 3.19 (3) 40 (4) 125.6 (5) 12.7

13. A light meter reads 2000 lx when aimed at a point light source from a distance of 10 cm. What will it read when placed 80 cm from the source and aimed at the source?

(1) 31 (2) 250 (3) 2000 (4) 159 (5) 286