Instructor: *P. Kumar*

PHYSICS DEPARTMENT

PHY 2049 Exam II June 17, 2009

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.

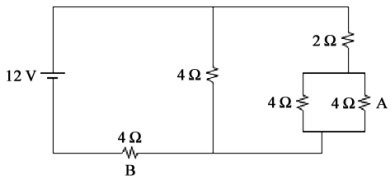
DIRECTIONS

(1) **Code your test number on your answer sheet (use 76–80 for the 5-digit number)**. Code your name on your answer sheet. **Darken circles completely (errors can occur if too light)**. Code your student number on your answer sheet.
(2) **Blacken the circle of your intended answer completely, using a number 2 pencil**. Do not make any stray marks or the answer sheet may not read properly.
(3) The answers are rounded off. Choose the closest to exact. There is no penalty for guessing.

Table of constants

$k = \frac{1}{4}\pi\epsilon_0$	$e = 1.6 \times 10^{-19}$C	$m_e = 9.11 \times 10^{-31}$kg

1. A circuit is drawn with four resistors of 4 Ohms and one resistor of 2 Ohm. An ideal 12V battery is connected to the circuit as shown. Two of the resistors are labeled A and B. What is the current through the resistor labeled B?



(1) 2A (2) 6A (3) 3A (4) 1.33A (5) 4A

2. In the figure in the problem above, what is the power dissipated in the resistor marked A?

(1) 1 W (2) 2W (3) 4W (4) 16W (5) 24W

3. Two conductors are made of the same material and have the same length. Conductor A is a solid wire of diameter 2m. Conductor B is a hollow tube of inside diameter 2m and outside diameter 4m. The ratio of their resistance, R_A/R_B, is:

(1) 3 (2) 5/4 (3) 1/3 (4) 4 (5) 1/4

4. An unknown resistor and a capacitor of 0.323μF are connected in series. A 13.0 V potential difference is suddenly applied across them. The potential difference across the capacitor rises to 7.00 V in 1.50μs. What is the unknown resistance (in Ω)?

(1) 6 (2) 18 (3) 0.16 (4) 0.05 (5) 1.5

5. A wire having a mass per unit length of 0.500 g/cm carries a 2.00-A current horizontally to the south. What are the direction and magnitude of the minimum magnetic field needed to lift this wire vertically upward?

(1) 0.25T, east (2) 2.45 T, east (3) 245 T, east (4) 0.25T, west (5) 2.45 T, west

6. A square wire loop of side length 10.0 cm carries a current of 10A. It is placed so that the normal to its plane makes an angle of 30° with respect to the direction of a uniform magnetic field of 4.0T. What is the magnitude of the torque acting on the loop in N-m?

(1) 0.20 (2) 0.63 (3) 4.0 (4) 0.35 (5) 10.0

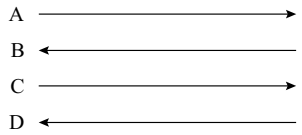
7. Protons are accelerated through a potential difference of 2500 V and enter a magnetic field region at an angle of 30° relative to the field direction where they move in a helical path at a frequency of 285 Hz. What is the frequency of helical motion for 14C nuclei (6 protons, 8 neutrons) that are accelerated by the same potential in the same direction?

(1) 122 Hz (2) 285 Hz (3) 380 Hz (4) 1710 Hz (5) 214 Hz

8. In a uniform magnetic field, an electron undergoes a circular motion with a kinetic energy of 6.4×10^{-17}J. The radius of the orbit is 23.0 mm. What is the magnetic field in T?

(1) 2.93×10^{-3} (2) 3.20×10^{-4} (3) 1.28×10^{-7} (4) 3.52×10^{-5} (5) 1.35×10^{-2}

9. Four long parallel wires are arranged on a plane, as shown in the attached figure, with 2.0 cm gaps between them. Each wire carries a 3.0 A current in the direction indicated by the arrow. On the wire labeled C, what is the magnetic force per meter in N/m?

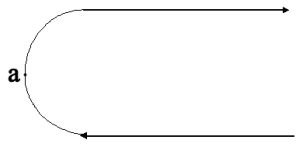


(1) 4.5×10^{-5} (2) 1.4×10^{-4} (3) 3.0×10^{-3} (4) 2.3×10^{-4} (5) 6.5×10^{-2}

10. Two long straight wires, lined along the z axis and with separation d along the x axis, carry currents i_1 and $i_2 = 2i_1$ out of the page. At what point on the x-axis is the net magnetic field due to the currents equal to zero?

(1) $d/3$ from wire 1 towards wire 2
(2) $d/3$ from wire 1 away from wire 2
(3) $2d$ from wire 2 away from wire 1
(4) $2d/3$ from wire 1 towards wire 2
(5) none of these.

11. In the figure, a current $i = 10$ A is set up in a long hairpin conductor formed by bending a wire into a semicircle of radius $R = 1.0$ mm. (Take the positive direction of the z axis to be out of the page.) What is the magnitude and direction of B at a?



(1) 0.005 T, into the paper
(2) 0.0100 T, out of the paper
(3) 0.0129 T, into the paper
(4) 0.0100 T, into the paper
(5) none of these

12. As a loop of wire with a resistance of 10Ω moves in a non-uniform magnetic field, it loses kinetic energy at a uniform rate of 5mJ/s. The induced emf in the loop:

(1) is 0.22 V (2) is 0 (3) is 0.28 V (4) is 2 V (5) cannot be calculated from the given data

13. To receive credit for this problem, you must correctly code ("bubble in") your UFID and your 5-digit test number (located at the top left and right hand corners of this test) onto your scan sheet and also select the correct response below. Please check now that you have correctly coded your exam number on the scan sheet.

(1) I have correctly bubbled my UFID number and 5-digit test code.
(2) I won't do this because I don't really need the credit.
(3) I don't know what my UFID number is.
(4) I wish all the questions were this easy.
(5) I don't understand what is being asked.