Instructor(s): *P. Kumar*

PHYSICS DEPARTMENT

PHY 2049 Exam 2 July 7, 2014

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** **<u>blue</u>** **or** **<u>black</u>** **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.

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1. A proton (charge e), traveling perpendicular to a magnetic field, experiences the same force as an lithium nucleus (charge $3e$) which is also traveling perpendicular to the same field. The ratio of their speeds, $v_{\text{proton}}/v_{\text{Li}}$, is:

(1) 3 (2) 0.5 (3) 1 (4) 4 (5) 2

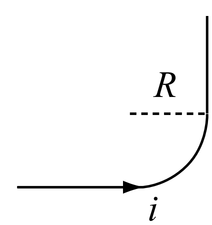
2. At one instant an electron (charge $= -1.6 \times 10^{-19}$C) is moving in the xy plane, the components of its velocity being $v_x = 5 \times 10^5$m/s and $v_y = 5 \times 10^5$m/s. A magnetic field of 0.8T is in the positive x direction. At that instant the magnitude of the magnetic force on the electron is:

(1) 6.4×10^{-14}N (2) 5.1×10^{-14}N (3) 0 (4) 3.8×10^{-14}N (5) 7.5×10^{-14}N

3. A loop of wire carrying a current of 2.0 A is in the shape of a right triangle with two equal sides, each 15 cm long. A 0.7 T uniform magnetic field is parallel to the hypotenuse. The resultant magnetic force on the two sides has a magnitude of:

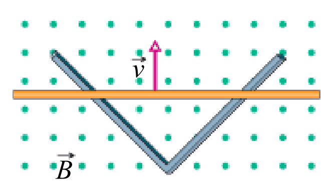
(1) 0 (2) 0.21 N (3) 0.30 N (4) 0.41 N (5) 0.51 N

4. A conducting wire is formed into two long, semi-infinite straight sections connected by a quarter circle of radius R, as shown in the figure. What is the magnitude and direction of the magnetic field at the center of the quarter circle?



(1) $(\mu_o i/4\pi R)(2 + \pi/2)$, out of the page
(2) $\mu_o i/4\pi R$, out of the page
(3) $\mu_o i/2\pi R$, into the page
(4) $\mu_o i/4R$, into the page
(5) none of these

5. Two straight conducting rails form a right angle. A conducting bar in contact with the rails starts at the vertex at time $t = 0$ and moves with a constant velocity of v m/s along them. A magnetic field with $B = 0.350$ T is directed out of the page. If the emf generated in the triangular loop at time $t = 4$s is 56.8 V, what is v (in m/s)?



(1) 4.5 (2) 2.6 (3) 5.2 (4) 6.5 (5) none of these

6. At a certain position outside Gainesville, the magnetic field of the Earth is 39μT, horizontal to the surface, and directed due North. If the magnitude of the total field is zero, exactly 8 cm below a long straight, horizontal wire that carries a constant current i, what is the magnitude and direction of the current?

(1) 16 A, east to west (2) 8 A, north to south (3) 16 A, west to east (4) 4.2 A, west to east (5) 8 A, south to north

7. A 100-watt light bulb is plugged into a 120 V outlet. The total charge passing through it in one hour is:

(1) 3000 C (2) 3600 C (3) 1800 C (4) 2400 C (5) 120 C

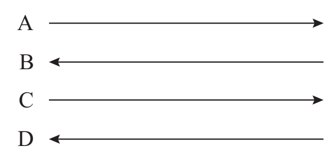
8. A wire having a mass per unit length of 0.500 g/cm carries a 2.00-A current horizontally to the south. What are the direction and magnitude of the minimum magnetic field needed to lift this wire vertically upward?

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

9. 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?

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

10. Four long parallel wires are arranged on a plane, as shown in the 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?

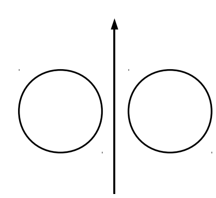


(1) 4.5×10^{-5} (2) 1.4×10^{-4} (3) 3.0×10^{-3} (4) 2.3×10^{-4} (5) 6.5×10^{-2}

11. As a loop of wire with a resistance of 50Ω moves in a non-uniform magnetic field, it loses kinetic energy at a uniform rate of 5mJ/s. The induced emf in the loop is:

(1) 0.5 V (2) 0 (3) 0.28 V (4) 2 V (5) cannot be calculated from the given data

12. The current I in a long wire is going up as shown in the figure, but increasing in magnitude. What is the direction of the induced current in the left loop and the right loop? (List the direction of the induced current in the left loop first.)



(1) clockwise, counterclockwise
(2) counterclockwise, clockwise
(3) clockwise, clockwise
(4) counterclockwise, counterclockwise
(5) There is no induced current.