

Instructor(s): Peter Hirschfeld

PHYSICS DEPARTMENT
EXAM II

PHY 2005, Spring 2016

March 23, 2016

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.

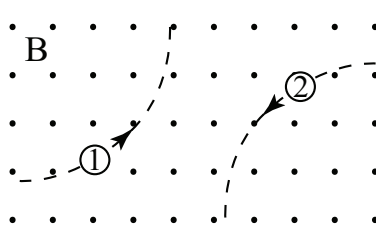
Physical Constants:

$g = 9.8 \text{ m/s}^2$	$m_e = 9.11 \times 10^{-31} \text{ Kg}$
$m_p = 1.67 \times 10^{-27} \text{ Kg}$	$e = 1.6 \times 10^{-19} \text{ C}$
constant k in Coulomb's Law: $k = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2$	
$\mu_o = 4\pi \times 10^{-7} \text{ T}\cdot\text{m/A}$	$\epsilon_o = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$

1. Which one of the following statements concerning the magnetic force on a charged particle in a magnetic field is true?
 - (1) It depends on the component of the particle's velocity that is perpendicular to the field.
 - (2) It is a maximum if the particle is stationary.
 - (3) It is zero if the particle moves perpendicular to the field.
 - (4) It is a maximum if the particle moves parallel to the field.
 - (5) It acts in the direction of motion for a positively charged particle.

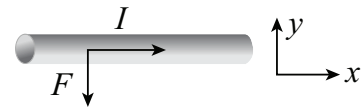
2. An electron is moving with a speed of $3.5 \times 10^5 \text{ m/s}$ when it encounters a magnetic field of 0.60 T. The direction of the magnetic field makes an angle of 60.0° with respect to the velocity of the electron. What is the magnitude of the magnetic force on the electron? (in N)
 - (1) 2.9×10^{-14}
 - (2) 4.9×10^{-13}
 - (3) 1.7×10^{-13}
 - (4) 3.2×10^{-13}
 - (5) 3.4×10^{-14}

3. 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?

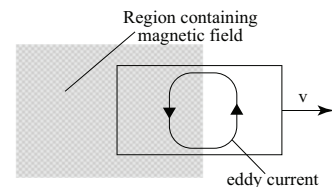


 - (1) Particle 1 is negatively charged; 2 is negative.
 - (2) The particles may both be neutral.
 - (3) Particle 1 is positively charged; 2 is negative.
 - (4) Particle 1 is positively charged; 2 is positive.
 - (5) Particle 1 is negatively charged; 2 is positive.

4. The local radio station WUFT broadcasts at approximately 90MHz = $9 \times 10^7 \text{ Hz}$. Which is closest to the wavelength of these radio waves?
 - (1) 3m
 - (2) 3 cm
 - (3) 3 mm
 - (4) 3 km
 - (5) 3 nm



5. A long, straight wire carries a 6.0 A current that is directed in the positive x direction. When a uniform magnetic field is applied perpendicular to a 3.0-m segment of the wire, the magnetic force on the segment is 0.36 N, directed in the negative y direction, as shown. What are the magnitude and direction of the magnetic field?
- (1) 0.020 T, out of the paper
 - (2) 0.060 T, out of the paper
 - (3) 0.65 T, out of the paper
 - (4) 0.020 T, into the paper
 - (5) 0.060 T, into the paper
6. An overhead electric power line carries a maximum current of 125 A. What is the magnitude of the maximum magnetic field at a point 4.50 m directly below the power line? (in tesla)
- (1) 5.56×10^{-6}
 - (2) 3.49×10^{-5}
 - (3) 7.95×10^{-3}
 - (4) 1.75×10^{-5}
 - (5) 4.69×10^{-4}
7. A di-valent ion with $q = +2e$ and $m = 19 \times 10^{-27}$ kg is moving with a speed 5×10^4 m/s perpendicular to a magnetic field. What must be the magnitude of the field if the particle is to follow a circle with 0.5 m radius? (in tesla)
- (1) 0.0059
 - (2) 0.012
 - (3) 0.09
 - (4) 0.0036
 - (5) 0.072
8. Two parallel wires lie 5 cm apart on a tabletop. They carry 5 A current in each wire in the same direction. Now the current has increased to 15 A in each wire. The force acting on each wire
- (1) is 9 times larger than that with 5 A current in each wire.
 - (2) is 3 times larger than that with 5 A current in each wire.
 - (3) is exactly same as that with 5 A current in each wire.
 - (4) is now in the opposite direction.
 - (5) is 2 times larger than that with 5 A current and in the opposite direction.
9. A 2 m long straight conducting wire is moving sideways with a constant speed perpendicular to a magnetic field of $B = 0.5$ T. The electric potential induced across the wire is 9 V. What is the speed of the moving wire? (in m/s)
- (1) 9
 - (2) 36
 - (3) 7.6
 - (4) 1.8
 - (5) 3.9
10. A flat loop of wire has an area of 40 cm^2 . It is in a region where $B = 400$ G and is directed along the x -axis. Call θ the angle between the axis of the loop and the x -axis. What is the change in flux through the loop as θ is changed from 30° to 60° ? (in Tm^2)
- (1) -5.86×10^{-5}
 - (2) -4.67×10^{-6}
 - (3) 5.6×10^{-6}
 - (4) 1.42×10^{-4}
 - (5) 3.3×10^{-3}
11. 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.

12. A vertically polarized light beam is passed through an ideal horizontal polarizer, and no light is transmitted. Another ideal polarizer, this time polarized at 45° with respect to the vertical, is inserted in the beam *before* the horizontal polarizer. What fraction of the intensity is now transmitted?

- (1) $1/4$
- (2) zero
- (3) $1/2$
- (4) not enough information
- (5) $1/\sqrt{2}$