

Instructor(s): *P. Kumar*PHYSICS DEPARTMENT  
Final Exam

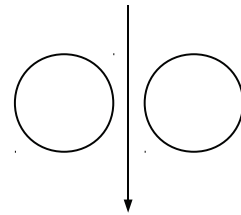
August 6, 2014

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 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.

1. The current  $I$  in a long wire is going down 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.)

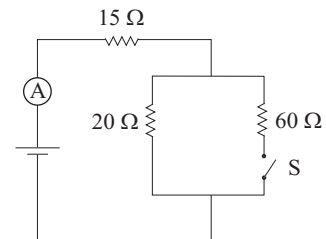


- (1) counterclockwise, clockwise
  - (2) clockwise, counterclockwise
  - (3) clockwise, clockwise
  - (4) counterclockwise, counterclockwise
  - (5) There is no induced current.
2. A wire having a mass per unit length of  $1.00 \text{ g/cm}$  carries a  $2.00\text{-A}$  current horizontally to the north. What are the direction and magnitude of the minimum magnetic field needed to lift this wire vertically upward?

- (1)  $0.5 \text{ T}$ , west      (2)  $0.5 \text{ T}$ , east      (3)  $5 \text{ T}$ , east      (4)  $5 \text{ T}$ , west      (5)  $0.25 \text{ T}$ , east

3. When switch  $S$  is open, the ammeter in the circuit shown reads  $3.0 \text{ A}$ . When  $S$  is closed, the ammeter reading:

- (1)  $3.5 \text{ A}$
- (2)  $3.0 \text{ A}$
- (3)  $1.0 \text{ A}$
- (4)  $2.5 \text{ A}$
- (5)  $2.0 \text{ A}$

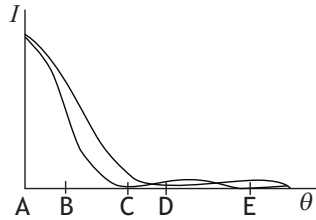


4. You have a wire with of length  $L$  and resistance  $R = 36\Omega$ . You turn it into a ring and then connect the two terminals of an ohmmeter at two points on the circumference of the ring that make an angle of  $30^\circ$  at the center of the ring. What is the resistance, in  $\Omega$ , measured by the ohmmeter?

- (1) 2.75      (2) 0.36      (3) 0.22      (4) 5      (5) none of these

5. A capacitor in an  $LC$  oscillator has a maximum potential difference of  $15 \text{ V}$  and maximum energy of  $360\mu\text{J}$ . At a certain instant, the energy in the capacitor is  $40\mu\text{J}$ . At that instant, what is the potential difference across the capacitor?

- (1)  $5 \text{ V}$       (2) zero      (3)  $10 \text{ V}$       (4)  $15 \text{ V}$       (5)  $20 \text{ V}$

6. At what distance in front of a concave mirror must an object be placed so that the image and object are the same size?
- (1) twice a focal length
  - (2) a focal length
  - (3) half a focal length
  - (4) less than half a focal length
  - (5) more than twice a focal length
7. A 3-cm high object is in front of a thin lens. The object distance is 4 cm and the image distance is  $-8$  cm. The image height is:
- (1) 6 cm
  - (2) 1 cm
  - (3) 1.5 cm
  - (4) 0.5 cm
  - (5) 24 cm
8. In a Young's double-slit experiment, light of wavelength 500 nm illuminates two slits which are separated by 1 mm. The separation between adjacent bright fringes on a screen 5 m from the slits is:
- (1) 0.25 cm
  - (2) 0.10 cm
  - (3) 0.50 cm
  - (4) 1.0 cm
  - (5) none of these
9. Two wavelengths, 800 nm and 600 nm, are used separately in single-slit diffraction experiments. The diagram shows the intensities on a far-away viewing screen as function of the angle made by the rays with the straight-ahead direction. If both wavelengths are then used simultaneously, at which angle is the light on the screen purely 800-nm light?
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- (1) C
  - (2) B
  - (3) A
  - (4) D
  - (5) E
10. Two identical conducting spheres A and B carry equal charge. They are separated by a distance much larger than their diameters. A third identical conducting sphere C is uncharged. Sphere C is first touched to A, then to B, and then removed. Finally, spheres A and B are brought into contact and then separated. As a result, the electrostatic force between A and B, which was originally  $F$ , becomes:
- (1)  $25F/64$
  - (2)  $F/2$
  - (3)  $F/4$
  - (4)  $5F/8$
  - (5)  $3F/8$
11. A capacitor is connected in series with a resistor and a switch. With the switch open, the capacitor is charged to 9.0 V. When the switch is closed, how long will it take for the voltage across the capacitor to drop to 6.0 V if the time constant of the circuit is 4.0 s?
- (1) 1.6 s
  - (2) 1.2 s
  - (3) 8 S
  - (4) 2.7 s
  - (5) 12 s
12. One hundred turns of insulated copper wire are wrapped around an iron core of cross-sectional area  $0.100\text{m}^2$ . The circuit is completed by connecting the coil to a  $10\Omega$  resistor. As the magnetic field along the coil axis changes from 1.00T in one direction to 1.00T in the other direction, the total charge that flows through the resistor is:
- (1) 2 C
  - (2) 10 mC
  - (3) 20 mC
  - (4) 1 C
  - (5) 0.20 C