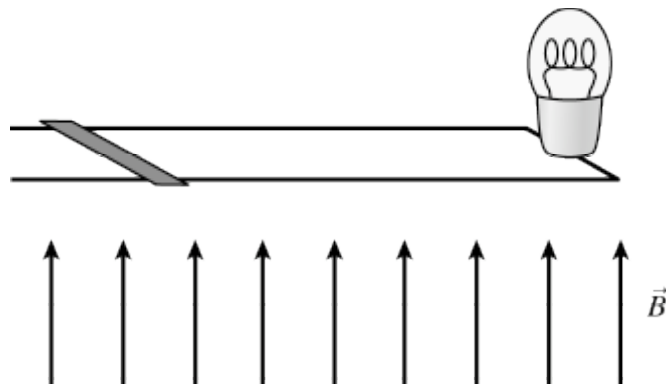


INSTRUCTIONS: Fill, tear and return the bottom strip of the front page with your scantron. Keep the top portion of the front page and the rest of the quiz. Use a pencil #2 to fill your scantron. Write your code number and bubble it in under "EXAM NUMBER". Bubble in the quiz form (see letter A--D at bottom of page) in your scantron under "TEST FORM"

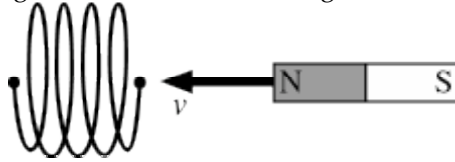
Useful numbers:  $K = 9.0 \times 10^9 \text{ Nm}^2/\text{C}^2$ ,  $\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{Nm}^2$ ,  $e = 1.60 \times 10^{-19} \text{ C}$ ,  $m_e = 9.11 \times 10^{-31} \text{ kg}$   
 $\mu_0 = 4\pi \times 10^{-7} \text{ T m/A}$

- 1) A conducting bar is free to slide horizontally on the rails of a conducting frame, as shown in the figure below. A light bulb is attached to the right end of the rails. A spatially uniform magnetic field is oriented vertically (perpendicular to the horizontal plane of the rails and bar). Initially the bar is stationary. The strength of the magnetic field begins increasing in time at a constant rate, which induces a current through the bar, frame, and light bulb. The bar begins to move due to the magnetic force exerted on it. Once the bar begins to move, the brightness of the light bulb

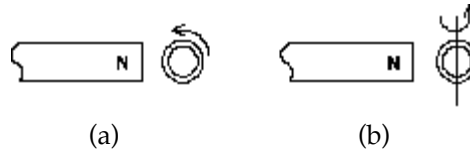


- A) decreases.  
 B) suddenly drops to zero.  
 C) stays the same.  
 D) increases.
- 2) For a long solenoid, the magnetic field strength within the solenoid is given by the equation  $B = 4.0t$  T, where  $t$  is time in seconds. If the induced electric field outside the solenoid is  $13 \text{ V/m}$  a distance  $7.0 \text{ m}$  from the axis of the solenoid, find the radius of the solenoid.
- A)  $6.7 \text{ m}$                       B)  $2,070 \text{ m}$                       C)  $7.5 \text{ m}$                       D)  $46 \text{ m}$

- 3) While a magnet is moved towards the end of a solenoid, a voltage difference is induced between the two ends of the solenoid wire. The voltage difference would be larger if

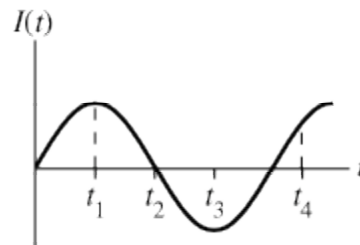
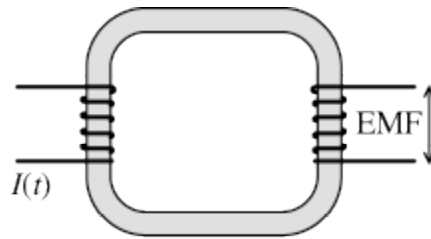


- A) the solenoid contained more loops (while having the same length).  
 B) the speed of the magnet were increased.  
 C) The bar magnet produced a stronger magnetic field.  
 D) All of the above statements are true.  
 E) Only two of the above statements are true.
- 4) The figure bellow shows two identical set-ups, each consisting of a conducting ring located near the N pole of a strong permanent magnet. The rings are then set to rotate with the *same* angular velocity but about different axes, as indicated in the figure. Which of the following statements best characterizes the currents in these setups?



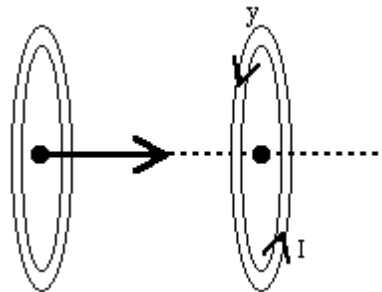
- A)  $I_b > I_a \neq 0$       B)  $I_a > I_b \neq 0$       C)  $I_a = I_b \neq 0$       D)  $I_a > I_b \neq 0$       E)  $I_b > I_a = 0$
- 5) A circular conducting loop with a radius of 1.00 m and a small gap filled with a  $10.0 \, \Omega$  resistor is oriented in the  $xy$ -plane. If a magnetic field of 3.0 T, making an angle of  $30^\circ$  with the  $z$ -axis, steadily increases to 10.0 T in 2.0 s, what is the magnitude of the current that will be caused to flow in the conductor during this time?
- A) 0.95 A      B) 0.095 A      C) 0.25 A      D) 0.55 A
- 6) A 6.0 A current passes through an inductor. If the inductor stores 19 J of energy, what is the inductance?
- A) 114 H  
 B) 342 H  
 C) 2.5 H  
 D) 1.06 H  
 E) Cannot be determined without knowing the rate of change of current,  $dI/dt$ .

- 7) An AC current is flowing through the primary of a transformer, and the magnitude of the current as a function of time is shown below. At which moment in time is the induced EMF across the secondary of the transformer largest?



- A)  $t_1$                       B)  $t_2$                       C)  $t_3$                       D)  $t_4$

- 8) A closed, circular loop has a current flowing through it. A second, closed, circular conducting loop with the same radius approaches this loop along a common axis as shown. Which of the following is true



- A) A current will flow in the approaching loop, in the opposite direction as in the first loop. This causes a repulsive force between the loops.  
 B) A current will flow in the approaching loop, in the opposite direction as in the first loop. This causes an attractive force between the loops.  
 C) No current will flow in the approaching loop. There is no force between the loops.  
 D) A current will flow in the approaching loop, in the same direction as in the first loop. This causes an attractive force between the loops.  
 E) A current will flow in the approaching loop, in the same direction as in the first loop. This causes a repulsive force between the loops.

## Answer Key

Testname: QZ8

- 1) A
- 2) A
- 3) D
- 4) E
- 5) A
- 6) D
- 7) B
- 8) A

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Name \_\_\_\_\_ Quiz ID \_\_\_\_\_  
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