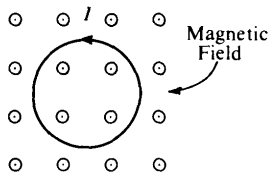
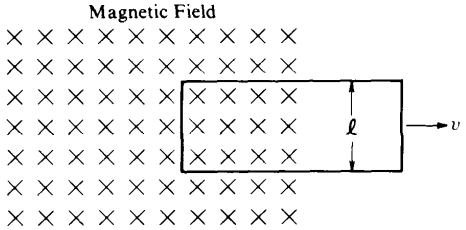


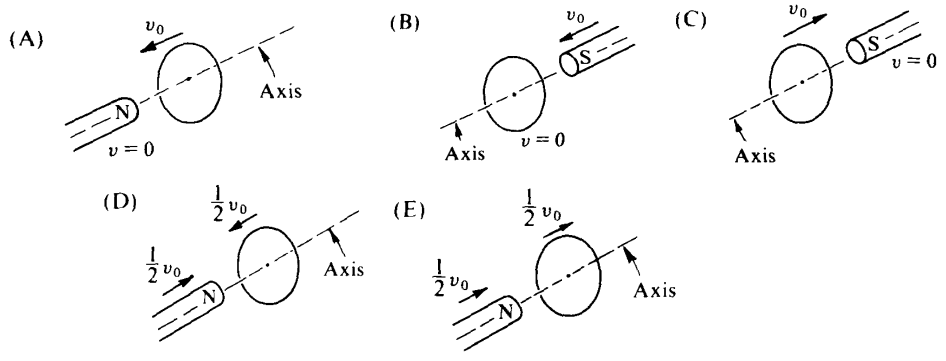
1. There is a counterclockwise current I in a circular loop of wire situated in an external magnetic field directed out of the page as shown above. The effect of the forces that act on this current is to make the loop
   (A) expand in size (B) contract in size (C) rotate about an axis perpendicular to the page
   (D) rotate about an axis in the plane of the page (E) accelerate into the page

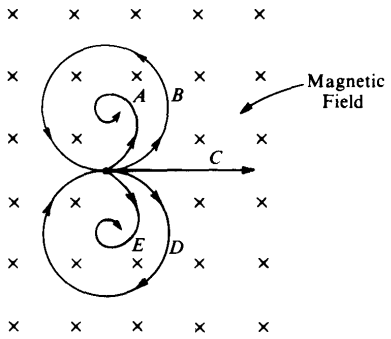


2. The figure above shows a rectangular loop of wire of width l and resistance R. One end of the loop is in a uniform magnetic field of strength B at right angles to the plane of the loop. The loop is pulled to the right at a constant speed v. What are the magnitude and direction of the induced current in the loop?

Magnitude	Direction
(A) BlvR	Clockwise
(B) BlvR	Counterclockwise
(C) Blv/R	Clockwise
(D) Blv/R	Counterclockwise
(E) 0	Undefined

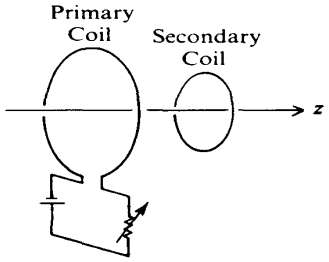
3. In each of the following situations, a bar magnet is aligned along the axis of a conducting loop. The magnet and the loop move with the indicated velocities. In which situation will the bar magnet NOT induce a current in the conducting loop?



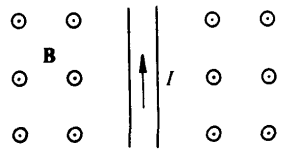


4. Which of the paths above represents the path of an electron traveling without any loss of energy through a uniform magnetic field directed into the page?
(A) A (B) B (C) C (D) D (E) E

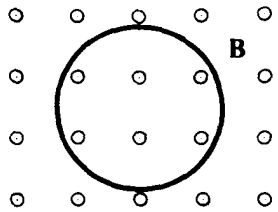
5. Two long, parallel wires, fixed in space, carry currents I_1 and I_2. The force of attraction has magnitude F. What currents will give an attractive force of magnitude 4F?
(A) $2I_1$ and $\frac{1}{2}I_2$ (B) I_1 and $\frac{1}{4}I_2$ (C) $\frac{1}{2}I_1$ and $\frac{1}{2}I_2$ (D) $2I_1$ and $2I_2$ (E) $4I_1$ and $4I_2$



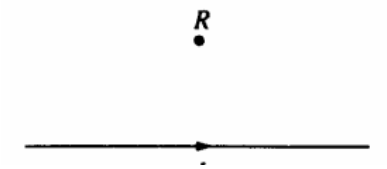
6. Two circular coils are situated perpendicular to the z-axis as shown above. There is a current in the primary coil. All of the following procedures will induce a current in the secondary coil EXCEPT
(A) rotating the secondary coil about the z-axis (B) rotating the secondary coil about a diameter
(C) moving the secondary coil closer to the primary coil (D) varying the current in the primary coil
(E) decreasing the cross-sectional area of the secondary coil



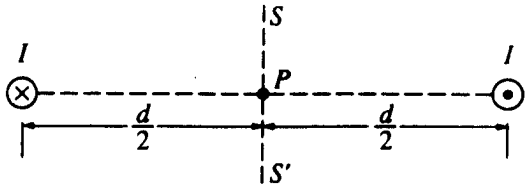
7. A wire in the plane of the page carries a current directed toward the top of the page as shown above. If the wire is located in a uniform magnetic field B directed out of the page, the force on the wire resulting from the magnetic field is
(A) directed into the page (B) directed out of the page (C) directed to the right
(D) directed to the left (E) zero



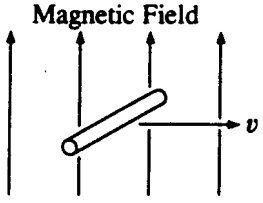
8. A magnetic field B that is decreasing with time is directed out of the page and passes through a loop of wire in the plane of the page, as shown above. Which of the following is true of the induced current in the wire loop?
(A) It is counterclockwise in direction. (B) It is clockwise in direction. (C) It is directed into the page.
(D) It is directed out of the page. (E) It is zero in magnitude.



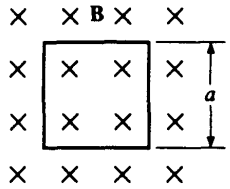
9. The direction of the magnetic field at point R caused by the current I in the wire shown above is
(A) to the left (B) to the right (C) toward the wire (D) into the page (E) out of the page



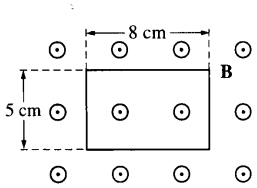
10. Two long, parallel wires are separated by a distance d, as shown above. One wire carries a steady current I into the plane of the page while the other wire carries a steady current I out of the page. At what points in the plane of the page and outside the wires, besides points at infinity, is the magnetic field due to the currents zero?
(A) Only at point P
(B) At all points on the line SS'
(C) At all points on the line connecting the two wires
(D) At all points on a circle of radius 2d centered on point P
(E) At no points



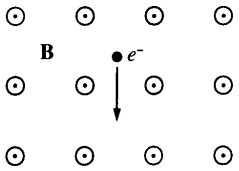
11. A wire of constant length is moving in a constant magnetic field, as shown above. The wire and the velocity vector are perpendicular to each other and are both perpendicular to the field. Which of the following graphs best represents the potential difference E between the ends of the wire as a function of velocity?



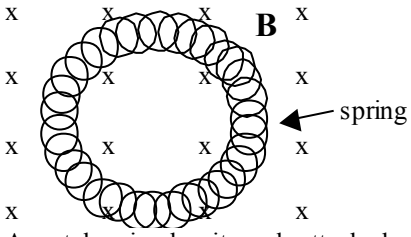
12. A square loop of wire of resistance R and side a is oriented with its plane perpendicular to a magnetic field B, as shown above. What must be the rate of change of the magnetic field in order to produce a current I in the loop? (A) IR/a^2 (B) Ia^2/R (C) Ia/R (D) Ra/I (E) IRa



13. A rectangular wire loop is at rest in a uniform magnetic field B of magnitude 2 T that is directed out of the page. The loop measures 5 cm by 8 cm, and the plane of the loop is perpendicular to the field, as shown above. The total magnetic flux through the loop is
(A) zero (B) 2×10^{-3} T-m^2 (C) 8×10^{-3} T-m^2 (D) 2×10^{-1} T-m^2 (E) 8×10^{-1} T-m



14. An electron is in a uniform magnetic field B that is directed out of the plane of the page, as shown above. When the electron is moving in the plane of the page in the direction indicated by the arrow, the force on the electron is directed
(A) toward the right (B) out of the page (C) into the page (D) toward the top of the page
(E) toward the bottom of the page



15. A metal spring has its ends attached so that if forms a circle. It is placed in a uniform magnetic field, as shown above. Which of the following will not cause a current to be induced in the spring?
(A) Changing the magnitude of the magnetic field
(B) Increasing the diameter of the circle by stretching the spring
(C) Rotating the spring about a diameter
(D) Moving the spring parallel to the magnetic field
(E) Moving the spring in and out of the magnetic field

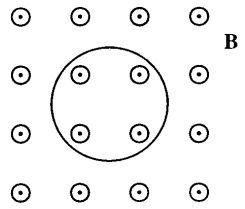
Questions 16-17
A magnetic field of 0.1T forces a proton beam of 1.5 mA to move in a circle of radius 0.1 m. The plane of the circle is perpendicular to the magnetic field.

16. Of the following, which is the best estimate of the work done by the magnetic field on the protons during one complete orbit of the circle?

(A) 0 J (B) 10^{-22} J (C) 10^{-5} J (D) 10^{2} J (E) 10^{20} J

17. Of the following, which is the best estimate of the speed of a proton in the beam as it moves in the circle?

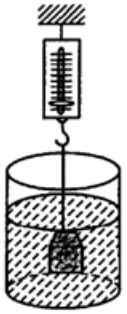
(A) 10^{-2} m/s (B) 10^{3} m/s (C) 10^{6} m/s (D) 10^{8} m/s (E) 10^{15} m/s



18. A single circular loop of wire in the plane of the page is perpendicular to a uniform magnetic field B directed out of the page, as shown above. If the magnitude of the magnetic field is decreasing, then the induced current in the wire is

(A) directed upward out of the paper (B) directed downward into the paper
(C) clockwise around the loop (D) counterclockwise around the loop
(E) zero (no current is induced)

Some "random" MC questions from previous units!



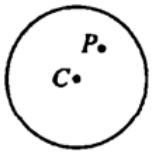
19. The figure above shows an object of mass 0.4 kg that is suspended from a scale and submerged in a liquid. If the reading on the scale is 3 N, then the buoyant force that the fluid exerts on the object is most nearly

a. 1.3 N b. 1.0 N c. 0.75 N d. 0.33 N e. 0.25 N

20. An ideal gas may be taken from one state to another state with a different pressure, volume, and temperature along several different paths. Quantities that will always be the same for this process, regardless of which path is taken, include which of the following?

I. The change in internal energy of the gas
II. The heat exchanged between the gas and its surroundings
III. The work done by the gas

a. I only b. II only. c. I and III only d. II and III only e. I, II, and III



21. The hollow metal sphere shown above is positively charged. Point C is the center of the sphere and point P is any other point within the sphere. Which of the following is true of the electric field at these points?
    a. It is zero at both points.
    b. It is zero at C, but at P it is not zero and is directed inward.
    c. It is zero at C, but at P it is not zero and is directed outward.
    d. It is zero at P, but at C it is not zero.
    e. It is not zero at either point.

22. The total capacitance of several capacitors in parallel is the sum of the individual capacitances for which of the following reasons?
    a. The charge on each capacitor depends on its capacitance, but the potential difference across each is
    the same.
    b. The charge is the same on each capacitor, but the potential difference across each capacitor
    depends on its capacitance.
    c. Equivalent capacitance is always greater than the largest capacitance.
    d. Capacitors in a circuit always combine like resistors in series.
    e. The parallel combination increases the effective separation of the plates.

23. A wire of length L and radius r has a resistance R. What is the resistance of a second wire made from the same material that has a length $L/2$ and a radius $r/2$?
    a. $4R$ b. $2R$ c. R d. $R/2$ e. $R/4$

24. Which of the following will occur if the average speed of the gas molecules in a closed rigid container is increased?
    a. The density of the gas will decrease. b. The density of the gas will increase.
    c. The pressure of the gas will increase. d. The pressure of the gas will decrease.
    e. The temperature of the gas will decrease.