1) A flat coil is in a uniform magnetic field. The magnetic flux through the coil is greatest when the plane of its area is
   A) perpendicular to the magnetic field.
   B) at 45° with the magnetic field.
   C) parallel to the magnetic field.

2) According to Faraday's law, a coil in a strong magnetic field must have a greater induced emf in it than a coil in a weak magnetic field.
   A) True B) False

3) According to Lenz's law, the induced current in a circuit always flows to oppose the external magnetic flux through the circuit.
   A) True B) False

4) A coil lies flat on a horizontal tabletop in a region where the magnetic field points straight down. The magnetic field disappears suddenly. When viewed from above, what is the direction of the induced current in this coil as the field disappears?
   A) There is no induced current in this coil.
   B) counterclockwise
   C) clockwise
   D) clockwise initially, then counterclockwise before stopping

5) A long straight wire lies on a horizontal table and carries an ever–increasing current toward the north. Two coils of wire lie flat on the table, one on either side of the wire. When viewed from above, the direction of the induced current in these coils is
   A) clockwise in the east coil and counterclockwise in the west coil.
   B) counterclockwise in both coils.
   C) counterclockwise in the east coil and clockwise in the west coil.
   D) clockwise in both coils.

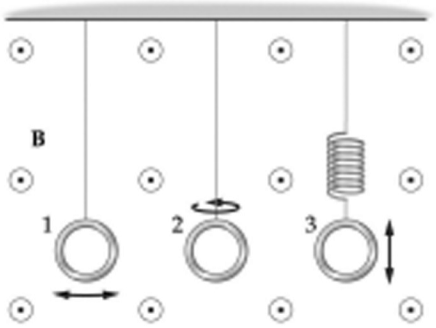
6) A bar magnet is oriented above a copper ring, as shown in the figure. If the magnet is pulled upward, what is the direction of the current induced in the ring, as viewed from above?

A) There is no current B) counterclockwise C) clockwise

7) A bar magnet is oriented above a copper ring, as shown in the figure. The magnet is dropped and passes completely through the ring. As viewed from above, what is the direction of the current induced in the ring after the magnet has completely passed through the ring and is somewhat below it?

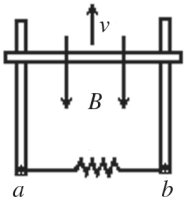
A) no current in the ring. B) counterclockwise C) clockwise

8) The three loops of wire shown in the figure are all hanging in the same uniform magnetic field $\vec{B}$ that is perpendicular to the page and does not vary with time. Loop 1 swings back and forth like the bob in a pendulum, Loop 2 rotates about a vertical axis, and Loop 3 oscillates up and down at the end of a spring. Which loop (or loops) will have an emf induced in them?



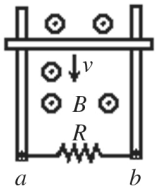
A) 1 B) 2 C) 3 D) 1 and 3 E) 2 and 3

9) As shown in the figure, a metal bar is in contact with a pair of parallel rails and is in motion with an upward velocity of magnitude v. A uniform magnetic field is present, directed downward as shown. The direction of the induced current through the resistor R is



A) from a to b. B) from b to a. C) No current is induced.

10) As shown in the figure, a metal bar is in contact with a pair of metal parallel rails. A steady uniform magnetic field B, perpendicular to the plane of the rails and pointing outward from the page, is present. The bar is in downward motion with velocity of magnitude v. The direction of the induced current through the resistor R is



A) from b to a. B) from a to b. C) No current is induced.

11) A transformer is a device used to
A) increase or decrease a dc voltage.
B) transform an alternating current into a direct current.
C) increase or decrease an ac voltage.
D) transform a direct current into an alternating current.

12) An inductor stores energy in its magnetic field.
A) True B) False

13) A flat circular loop of radius 0.10 m is rotating in a uniform magnetic field of 0.20 T. Find the magnetic flux through the loop when the plane of the loop and the magnetic field vector are parallel.

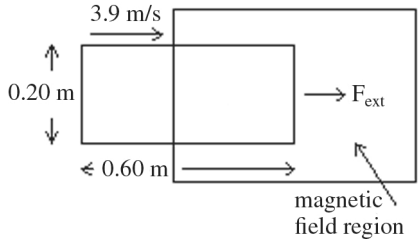
14) A 2.00–m long metal wire is formed into a square and placed in the horizontal xy–plane. A uniform magnetic field is oriented at 30° above the horizontal with a strength of 0.344 T. What is the magnetic flux through the square due to this field?

15) A flat coil having 40 turns, each one of cross–sectional area 12.0 cm^2, is oriented with its plane perpendicular to a uniform magnetic field. The field varies steadily from 0.00 T to 1.20 T in 20.0 ms. What emf is induced in the coil during this time?

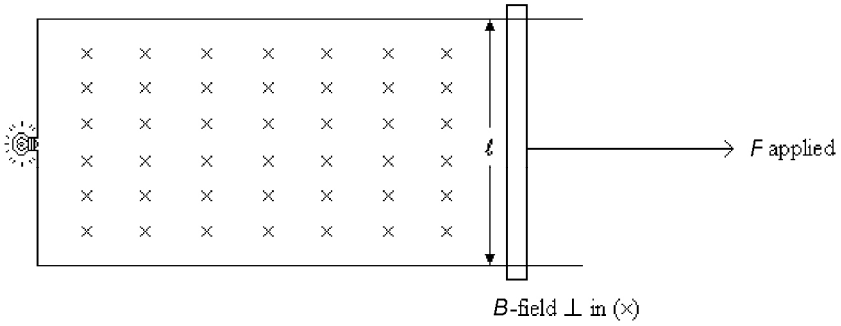
16) A circular coil of 20 turns and radius 5.0 cm is placed with its plane oriented at 90° to a uniform magnetic field of 0.10 T. The field is now increased at a steady rate, reaching a value of 0.50 T after 4.0 seconds. What emf is induced in the coil?

17) A round flat conducting loop is placed perpendicular to a uniform 0.50 T magnetic field. If the area of the loop increases at a rate of 3.0×10^{-3} m^2/s, what is the induced emf in the loop?

18) As shown in the figure, a region of space contains a uniform magnetic field. The magnitude of this field is 2.8 T, and it is directed straight into the plane of the page in the region shown. Outside this region the magnetic field is zero. A rectangular loop measuring 0.20 m by 0.60 m and having a resistance of 2 Ω is being pulled into the magnetic field by an external force, as shown.
(a) What is the direction (clockwise or counterclockwise) of the current induced in the loop?
(b) Calculate the magnitude of the external force F_{ext} that is required to move the loop at a constant speed of 3.9 m/s.



19) A conducting rod of length ℓ = 25 cm is placed on a U–shaped metal wire that is connected to a lightbulb having a resistance of 8.0 Ω, as shown in the figure. The wire and the rod are in the plane of the page. A constant uniform magnetic field of strength 0.40 T is applied perpendicular to and into the paper. An applied external force pulls the rod to the right with a constant speed of 6.0 m/s. What is the magnitude of the emf induced in the rod?



20) You wish to construct a simple ac generator with a maximum output of 12 V when rotated at 60 Hz. A magnetic field of 0.050 T is available. If the area of the rotating coil is 100 cm^2, how many turns are needed?

21) A circular coil with 600 turns has a radius of 15 cm. The coil is rotating about an axis perpendicular to a magnetic field of 0.020 T. If the maximum induced emf in the coil is 1.6 V, at what angular frequency is the coil rotating?

22) An ideal transformer has 60 turns on its primary coil and 300 turns on its secondary coil. If 120 V at 2.0 A is applied to the primary,
(a) what voltage is present in the secondary?
(b) what current is present in the secondary?

23) An ideal transformer steps down 120 V to 12. V and the 2630.–turn secondary supplies 12. A.
(a) Determine the current in the primary.
(b) Determine the turns ratio.
(c) What is the ratio of output power to input power?

Answer Key
Testname: CH21_MAGNETIC_INDUCTION

1) A
2) B
3) B
4) C
5) C
6) B
7) B
8) B
9) C
10) B
11) C
12) A
13) $0\ \text{T} \cdot \text{m}^2$
14) $0.0430\ \text{T} \cdot \text{m}^2$
15) 2.88 V
16) 0.016 V
17) 1.5 mV
18) (a) counterclockwise (b) 6×10^{-1} N
19) 0.60 V
20) 64
21) 1.9 rad/s
22) (a) 240 V (b) 0.40 A
23) (a) 1.2 A (b) 1.0:10. (c) 1:1 for ideal transformer