Name: _____ **Date:** _____ **Period:** _____

AP Physics C
Magnetic HO44

1.) A single loop of wire with an enclosed area of 0.0900 m^2 is in a region of uniform magnetic field, with the field perpendicular to the plane of the loop. The magnetic field has an initial value of 3.80 T and is decreasing at a constant rate of 0.190 T/s. If the loop has a resistance of 0.300 Ω, what is the current induced in the loop? (30-1)

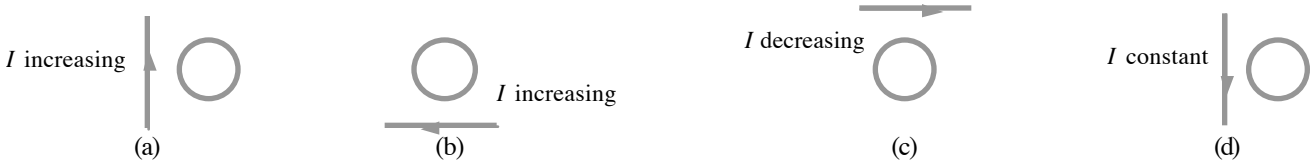
2.) A closely wound rectangular coil of 50 turns has dimensions of 12.0 cm x 25.0 cm. In time t = 0.0800 s the plane of the coil is rotated from a position where it makes an angle of 45.0° with a magnetic field of 0.975 T to a position perpendicular to the field. What is the average emf induced in the coil? (30-3)

3.) A coil 2.00 cm in radius, containing 400 turns, is placed in a magnetic field that varies with time according to $B = (0.0100\ \text{T/s})t + (2.00 \times 10^{-4}\ \text{T/s}^3)t^3$. The coil is connected to a 500 Ω resistor, and its plane is perpendicular to the magnetic field. (30-10)

a.) Find the magnitude of the induced emf in the coil as a function of time.

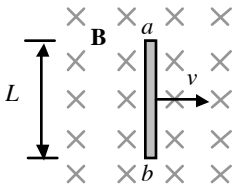
b.) What is the current in the resistor at time t = 10.0 s? (The resistance of the coil can be neglected.)

4.)



What is the direction of the induced current in the circular loop due to the current shown in each case shown above? (G21-8)

5.)



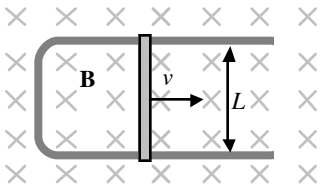
In the figure to the left a rod with length L = 0.190 m moves with constant speed 6.00 m/s in the direction shown. The induced emf is 2.00 V. (30-16)

a.) What is the magnitude of the magnetic field?

b.) Which point is at higher potential, a or b?

6.) In the figure for Problem 5 the rod has length L = 0.0550 m and moves in a magnetic field **B** of magnitude 0.500 T with a speed of 6.00 m/s in the direction shown. What is the motional emf induced in the rod? (30-18)

7.)



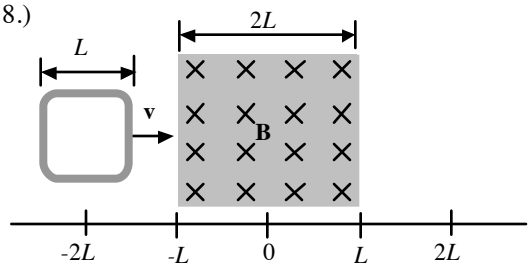
In the figure to the left, a rod with length L = 0.0650 m moves in a magnetic field with magnitude B = 1.20 T. The emf induced in the moving rod is 0.320 V. (30-19)

a.) What is the speed of the rod?

b.) If the total circuit resistance is 0.800 Ω, what is the induced current?

c.) What force does the field exert on the rod as a result of this current?

8.)



A square loop of wire with resistance R is moved at constant speed v across a uniform magnetic field confined to a square region whose sides are twice the length of those of the square loop. (30-21)

a.) Sketch a graph of the external force F needed to move the loop at constant speed, as a function of x, from $x = -2L$ to $x = +2L$. The x-coordinate is measured from the center of the moving loop. Take positive force to be to the right.

b.) Sketch a graph of the induced current in the loop as a function of x. Take counterclockwise currents to be positive.

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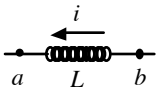
AP Physics C
Inductance HO45

1.) At the instant when the current in an inductor is increasing at a rate of 0.0600 A/s, the self-induced emf is 0.0180 V. (31-7)

a.) What is the inductance of the inductor?

b.) If the inductor is a solenoid with 300 turns, what is the average magnetic flux through each turn when the current is 0.80 A?

2.) When the current in a toroidal solenoid is changing at a rate of di/dt = -0.0350 A/s, the magnitude of the induced emf is 8.40 mV. When the current equals 1.25 A, the average flux through each turn of the solenoid is 0.00375 Wb. How many turns does the solenoid have? (31-8)

3.) 

The inductor in the figure to the left has inductance 0.540 H and carries a current in the direction shown that is decreasing at a uniform rate, di/dt = -0.0300 A/s. (31-9)

a.) Find the self-induced emf. b.) Which end of the inductor, *a* or *b*, is at a higher potential?

4.) An inductor has an inductance of 16.0 H and a resistance of 200 Ω and carries a current of 0.350 A. What is the energy stored in the magnetic field? (31-14)

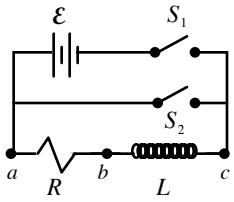
5.) Show that L/R has units of time. (31-19)

6.) An inductor with an inductance of 3.00 H and a resistance of 7.00 Ω is connected to the terminals of battery with an emf of 12.0 V and negligible internal resistance. (31-21)

a.) Find the initial rate of increase of current in the circuit.

b.) Find the rate of increase of current at the instant when the current is 1.00 A.

c.) Find the current 0.200 s after the circuit is closed. d.) Find the final steady-state current.

7.) 

In the figure to the left $\mathcal{E}$ = 120 V, R = 400 Ω, and L = 0.200 H. With switch S_2 open, switch S_1 is left closed until a constant current is established. Then switch S_2 is closed and S_1 is opened, taking the battery out of the circuit. (31-23)

a.) What is the initial current in the resistor, just after S_2 is closed and S_1 is opened?

b.) What is the current in the resistor at $t = 2.00 \times 10^{-4}$ s?

c.) What is the potential difference between points *b* and *c* at $t = 2.00 \times 10^{-4}$ s?

d.) How long does it take the current to decrease to half its initial value?

8.) In the figure for Problem 7, suppose that $\mathcal{E}$ = 80.0 V, R = 400 Ω, and L = 0.200 H. Initially, there is no current in the circuit. Switch S_2 is left open, and switch S_1 is closed. (31-24)

a.) Just after switch S_1 is closed, what are the potential differences v_{ab} and v_{bc}?

b.) A long time (many time constants) after S_1 is closed, what are v_{ab} and v_{bc}?

c.) What are v_{ab} and v_{bc} at an intermediate time when i = 0.0500 A?

9.) Show that $\sqrt{LC}$ has units of time. (31-27)