PHY 142

HW 8 Assigned Monday March 16th, due Monday March 30th

Kirchoff's Laws and Magnetic Induction

Questions and Problems together

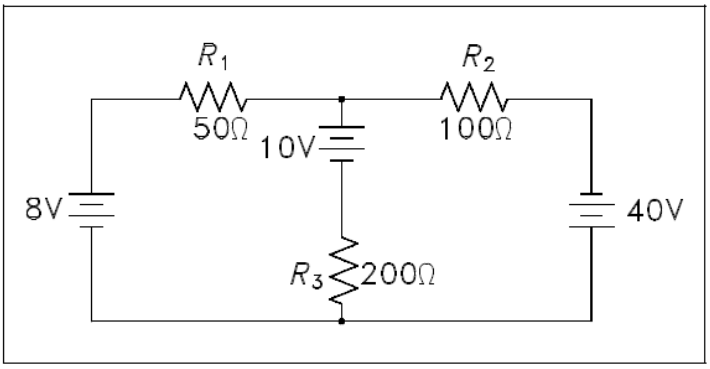

Figure 37 Example Circuit for Loop Equations

1. For the circuit on the right, solve for the magnitude and direction of the current in each loop.
2. The magnetic flux through a coil of wire containing two loops changes uniformly from 0.04 T to 0.3 T in 1.4 seconds. What is the emf induced in the coil?
3. A 25 cm diameter circular loop of wire lies in a plane perpendicular to a 0.8 T magnetic field. It is removed from the field in 0.2 seconds. What is the induced voltage?

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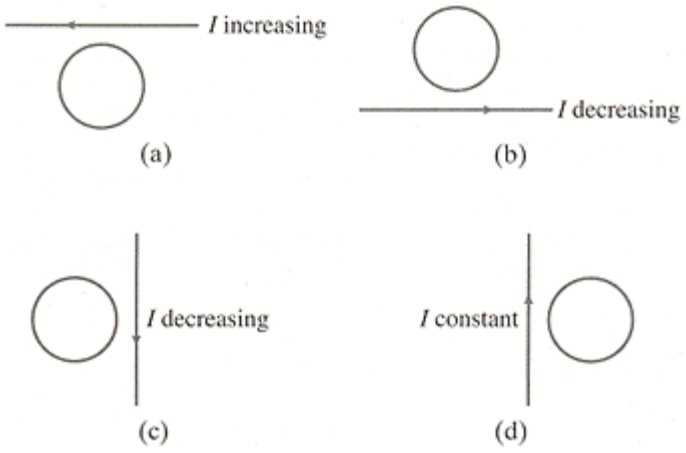
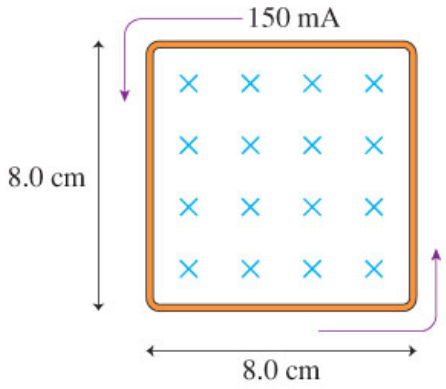
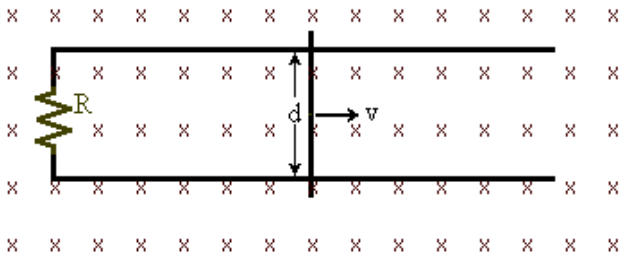
4. In the image on the right, four situations are shown (a – d). For each case, if the current in the long straight wire is directed as shown, and increasing or decreasing as noted, what will be the direction of the induced current in the loop? (or say zero if there is none.)



5. For part (a) of #4, suppose the current is increasing at a rate of 0.7 A/s. If the area of the loop is 3 cm^2 and its resistance is 400 ohms, what will be the magnitude of the induced current? (you may approximate the distance between the loop and the straight wire to be 5 cm)
6. For the loop pictured on the right, is the magnetic field shown increasing or decreasing? Calculate also the size of the rate of change in magnetic field (ie, $\Delta B/\Delta t$).



7. In the below image, R = 60 Ω, d = 1.2 m, and a uniform 2.5 T magnetic field is directed into the page. At what speed should the bar be moved to produce 0.5 A in the resistor? Will **I** be cw or ccw?



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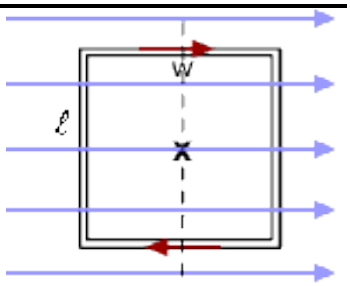
8. Suppose a current-carrying coil of wire is placed in a magnetic field as shown in the image on the right. If w = l = 3 cm, there are 4 loops, the current it carries is 300 mA (clockwise), and the magnetic field is 3 T directed to the right, what torque will be felt by the coil?
9. For the four sides of the square coil (on the right, and in #8), determine the direction of the force it feels.



10. You decide you don't want a magnetic field directed to the right, and rearrange so that it is pointed at 35 degrees N of E. What torque does the coil now feel? (you may assume it has been placed back in its original position as shown)

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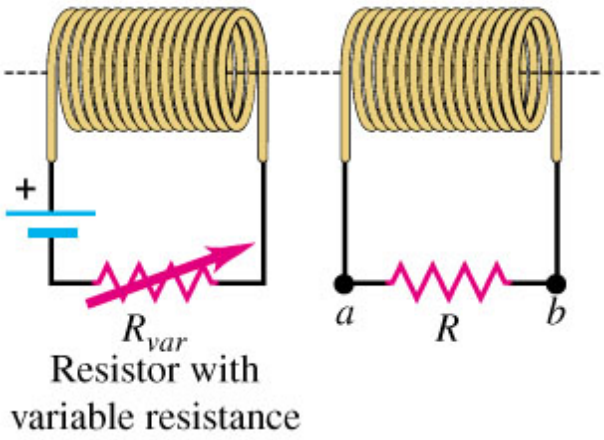
11. In the image on the right, the resistor in the left circuit is steadily reduced so that the current in the solenoid on the left decreases steadily at a rate of 0.2 A/S. What amount of induced current will occur in the right-hand coil if R = 4400 ohms, both coils have 150 loops, areas of 35 cm^2, and lengths of 10 cm?
12. For the right-hand coil, will the current through its resistor flow to the left or to the right? Explain.



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13. You have discovered magical, stretchy conductive wire. You create a loop with area 40 cm^2, and place it in a region where you have created a 0.6 T magnetic field. If you slowly stretch your loop to double its area, over a period of 3.2 seconds, what magnitude voltage will be produced? (You may assume that you place the loop so that its normal vector (area vector) is oriented perpendicular to the magnetic field.)