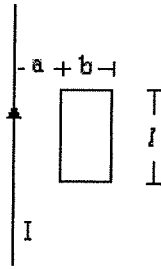
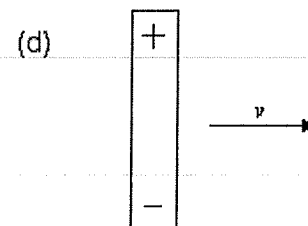
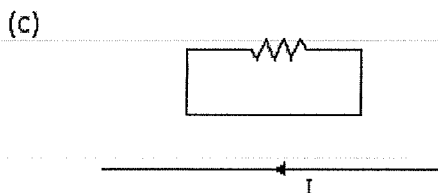
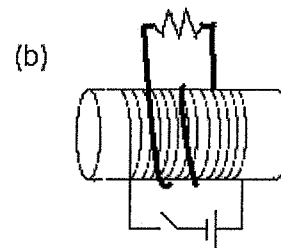
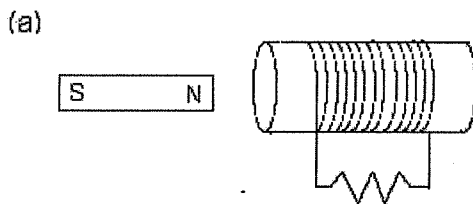


Physics 111 Homework Set #13 Chapter 31

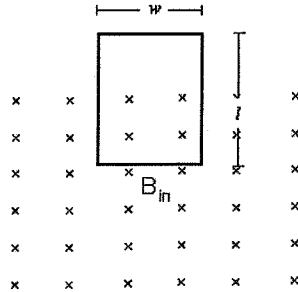
- 58) A powerful electromagnet has a field of 1.6 T and a cross sectional area of  $0.2 \text{ m}^2$ . If we place a coil having 200 turns and total resistance  $20\Omega$  around the electromagnet and then turn the power off in 20 ms, what is the current induced in the coil?
- 59) A long solenoid has  $n$  turns/meter and carries a current  $\mathbf{I} = I_0(1 - e^{-\alpha t})$  with  $I_0=30\text{A}$  and  $\alpha=1.6\text{s}^{-1}$ . Inside the solenoid and coaxial with it is a loop of radius  $R=6 \text{ cm}$  with  $N$  turns of wire. What is the emf induced in the loop? Take  $n=400$  turns/m and  $N=250$  turns.
- 60) A long straight wire carries a current  $\mathbf{I} = I_0\sin(\omega t + \delta)$  and lies in the plane of a rectangular loop of  $N$  turns. Determine the emf induced in the loop if  $I_0=50\text{A}$ ,  $\omega=200\pi \text{ s}^{-1}$ ,  $N=100$ ,  $a=b=5\text{cm}$ , and  $l=20\text{cm}$ .



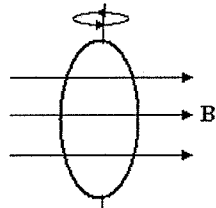
- 61) Use Lenz's law to answer the following questions: (a) What is the direction of the induced current in the resistor when the bar magnet is moved to the left? (b) What is the current in the resistor when the switch is closed? (c) What is the direction of the induced current in the resistor when the current decreases rapidly to zero? (d) A Cu bar is moved to the right while its axis is maintained perpendicular to the magnetic field. If the top of the bar becomes positive relative to the bottom, what is the direction of the B-field?



- 62) A conducting rectangular loop of mass  $M$ , resistance  $R$ , and dimension  $w$  wide by  $l$  long falls from rest into a B-field. The loop accelerates until it reaches the terminal speed,  $v_t$ . (a) Show that  $v_t = \frac{MgR}{B^2 w^2}$ . (b) Why is  $v_t$  proportional to  $R$ ? (c) Why is  $v_t$  inversely proportional to  $B^2$ ?



- 63) A loop of wire of area  $0.1\text{m}^2$  is rotating at  $60\text{ rev/s}$  with the axis of rotation perpendicular to a  $0.2\text{T}$  magnetic field as shown. (a) If there are 1000 turns of wire on the loop, what is the maximum induced voltage? (b) When the maximum voltage occurs, what is the orientation of the loop with respect to the B-field?



- 64) To monitor the breathing of a hospital patient, a thin belt is girded around the patient's chest. The belt is a 200 turn coil. When the patient inhales, the area of the loop changes by  $39\text{cm}^2$ . The magnitude of the earth's magnetic field is  $50\mu\text{T}$  and makes an angle of  $28^\circ$  with respect to the plane of the coil. If the patient takes  $1.8\text{s}$  to inhale, find the average induced emf.
- 65) A horizontal wire is free to slide on the vertical rails of a conducting frame. The wire has a mass  $m$  and length  $l$ , and the resistance of the circuit is  $R$ . If a uniform B field is directed perpendicular to the frame, what is the terminal speed of the bar?

