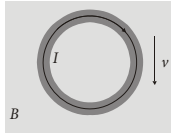


## INDUCED CURRENT AND INDUCTANCE OF A COIL

*Basic Problems:* Homework for Thursday, 14 September 06

### Basic Problems

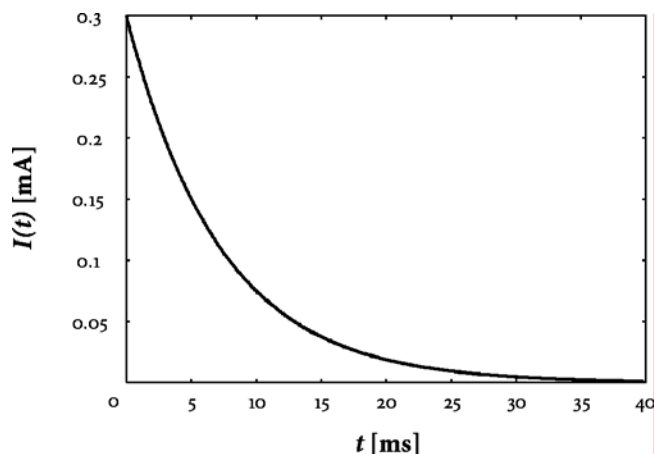
1. A metal ring moves vertically through a magnetic field  $B$ , leading to an induced current (see figure). What can you tell about the magnetic field?



2. A 40 cm long coil with cross section  $20 \text{ cm}^2$  and 600 turns and an iron core has an inductance of 2 H. Calculate the iron core's permeability.
3. Two identical wires are used to wind two solenoids of equal length, but with radii whose ratio is 2 : 1. Determine the ratio of the solenoid's inductances.
4. The current flowing through a coil with inductance 0.45 H has magnitude 5 A. When it is switched off, it breaks down to zero in 20 ms. Calculate the self-induced emf in the coil. What can be observed at the switch?
5. A coil with inductance 15 mH and resistance  $4.7 \text{ k}\Omega$  is connected to a power supply. How long does it take after switching off until the current has dropped to one eighth of its stationary value?

### Additional Problems

6. A 1.2 m long copper rod with resistance  $10 \text{ m}\Omega$  is moved at 2 m/s perpendicularly to the field lines of a magnetic field of magnitude 0.15 T. Calculate the force required to keep up a constant speed.
7. A coil with resistance  $R_1$  and a resistor with resistance  $R_2$  are connected in parallel to a 4.5 V supply. How can you choose the ratio of the two resistances in order not to let the switch-off voltage peak surpass 100 V?
8. An LR circuit contains a coil and a  $10 \text{ k}\Omega$  resistor. The diagram displays the measured breaking current.
  - a) Determine the breaking current's half life and calculate the coil's inductance.
  - b) Determine the magnitude of the voltage peak immediately after the switch has been opened.



Solutions to Basic Problems: 2. 900; 3. 1 : 1; 4. 110 V; 5.  $6.6 \mu\text{s}$