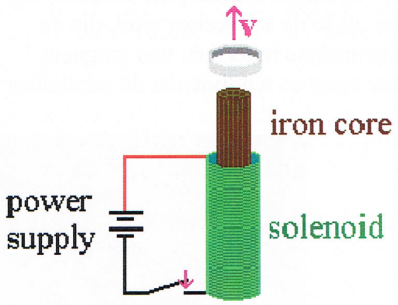
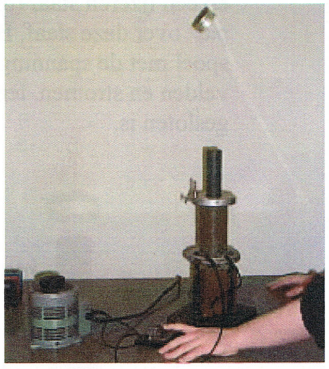
Tussen toets Electriciteit en Magnetisme 2
NABBEM05E.2011-2012.1A
October 6, 2011 11:00-13:00; room: X 5111:0022

Add your name and S number to each sheet of paper!
There are 4 questions with a total number of points: 20+20+20+40= 100

WRITE CLEARLY

1. In the figures below, you see the demonstration of the "jumping ring". As shown in the schematic picture on the left, the setup consists of a coil (green) and a rod of iron (brown) through the center of the coil. A metal ring fits over the rod. Describe what will happen if you close the switch which connects the coil with the power supply. Do this by analyzing the situation in terms of magnetic fields and currents while the switch is open and while the switch is closed.





2. A square loop of wire, with sides of length a lies in the first quadrant of the xy plane. One of the corners of this square is fixed at the origin; one side is along the $y=0$ axis, another along the $x=0$ axis. In this region there is a non-uniform time-dependent magnetic field with:

   $\vec{B}(y,t) = k\, y^2\, t^2\, \hat{z}$

   where k is a constant (in time and in x,y,z). Find the electromotive force (emf) in the loop.

3. Calculate the self-inductance per unit length of a long solenoid which has a radius R, carrying n turns per unit length.

4. Assume a magnet consisting of two flat poles. The magnetic field in the gap of this dipole magnet is uniform with strength B up to a radius r_0 from the center of the magnet. At a radius larger than r_0 the magnetic field is zero. The strength of the magnetic field is increasing in time: $B = (t/t_0)\, B_0$. Calculate in the mid-plane between the poles the strength of the electric field as a function of r and sketch the electric field lines.