

### Special Problem 8-3.5

A Solenoid of length  $L=0.1$  meters and radius of 0.01 meters is made with  $N=1000$  wire turns.

A current of 0.02 A is passing through the wire.

In the "core" (i.e., in the center) of the solenoid is a magnetic material with relative permeability  $\mu_r = 2.0$  (In other words, the center of the solenoid is no longer filled with "free space"!).

1. Determine (in terms of  $\mu_0$ ) the **magnetic flux density** in the core of the solenoid.
2. Determine (in terms of  $\mu_0$ ) the **magnetic field** in the core of the solenoid.
3. Determine (in terms of  $\mu_0$ ) the total **magnetic flux**  $\Phi$  flowing through the cross section  $S$  of the solenoid.