

PHYS 114 - Fifth Homework

1. Explain Gauss's Law using words only.
2. Suppose you have a thick wire made of a compressible conducting material. If there is a uniform current flowing through the wire, what will happen to the shape of the wire?
3. Suppose you place a metal in a uniform magnetic field. Do you expect to have magnetic field inside the metal, or would it be zero as in the case of an electric field?
4. A current I flows around the surface of a copper pipe of radius R and length L . Find a formula for the magnetic field on the axis of the pipe at a distance z from the center. Assume $z > L/2$ (H. C. Ohanian, "Physics," Ch. 30, Pr.34)
5. A rectangular loop of wire of dimensions $12\text{ cm} \times 25\text{ cm}$ faces a long straight wire. The two long sides of the loop are parallel to the wire, and the two short sides are perpendicular; the midpoint of the wire is 8.0 cm from the wire. Currents of 95 A and 70 A flow in the straight wire and the loop respectively.
 - (a) What translational force does the straight wire exert on the loop?
 - (b) What torque about an axis parallel to the straight wire and pass through the center of the loop does the straight wire exert on the loop?(H. C. Ohanian, "Physics", Ch. 31, Pr. 46)
6. Consider a circular conducting wire in a uniform magnetic field. The plane of the wire is perpendicular to the magnetic field. The radius of the wire changes with time as $r = r(t)$, where $r(t)$ is a general function of time. By considering the force acting on an electron on inside the wire, show explicitly that the emf around the wire is $\mathcal{E} = \frac{d\Phi_B}{dt}$ where Φ_B is the total magnetic flux inside the wire.