1. Two conducting spheres of radii a and b, respectively, are connected by a long, thin conducting wire. A charge of q is placed on this structure. Find
   (a) the charge on each sphere,
   (b) the electric field intensity on the surface of each sphere.

2. Two grounded plane parallel electrodes of width a are separated by a distance b and extend to infinity in the other direction. At $x=0$, a conducting surface is maintained at a potential V_1, and the plane at $x=a$ is occupied by a conductor maintained at a potential V_2. Find the electric potential V at any point between the electrodes. (Fig. 1)

3. Calculate the self-inductance per unit length of a coaxial line of radii a, b, c carrying currents I in opposite directions in the inner and outer conductors. (Fig. 2)

4. Inside a superconductor $\vec{E}=0$ and $\vec{B}=0$ under ideal conditions.
   (a) Show that, just outside, $\vec{B}$ is tangential to the surface.
   (b) Show that the current density due to free carriers is zero inside.
   (Assume steady state conditions and no magnetization)
   (c) Does there exist a relation between the tangential $\vec{B}$ and the surface current density?
   (d) Show that the magnetic flux linking a curve C which is entirely situated inside a pure superconducting material must be constant.

5. A plane electromagnetic wave propagates in a good conductor in the positive direction of the z-axis. Calculate
   (a) the total power lost per square meter by Joule heating between $z=0$ and $z\to\infty$.
   (b) the Poynting vector at $z=0$.

Fig. 1

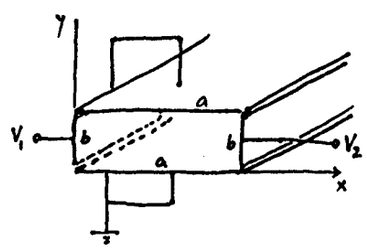

Fig. 2