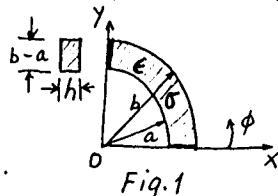


1. How much energy is required to assemble a uniform sphere of charge of radius R and volume charge density ρ coul/m³. (20%)
2. A conducting material of uniform thickness h and conductivity σ and permittivity ϵ has the shape of a quarter of a flat circular disk, with inner radius a and outer radius b , as shown in Fig.1. Determine



- (a) the resistance between the end faces,
(b) the capacitance between the end faces.
3. A piece of tissue with radius a and thickness b is shown in Fig.2. If a varying magnetic field $B(t)$ is applied axially to it, find the power produced in the tissue. $B(t) = kt$ where k is a constant.



4. Find the electric field and potential produced by an electric dipole with dipole moment $p = qd$. Draw some equipotential lines of this dipole. (20%)

The electrical activity of the human heart is due to the polarization and depolarization of its cells which can be treated as electric dipoles. How can the potential produced by the cells of the heart be employed to diagnose heart damage?

5. It is stated in an article "An electrifying new hazard" (20%) (U.S. News & World Report March 30, 1987) that some residents living near the high-voltage transmission lines long have complained of headaches, lethargy (昏睡), memory loss, more illnesses than usual. Could you give explanation of your own to the statement mentioned above based on the electromagnetic theorem?