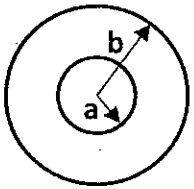


1. Please describe how Maxwell fixed Ampere's Law. How to verify the fixed term is correct? (25%)

[Hint: Originally Ampere's law only works in electrostatics. Maxwell added an additional term. You not only need to write down the term but also need to describe the logic how Maxwell fixed it.

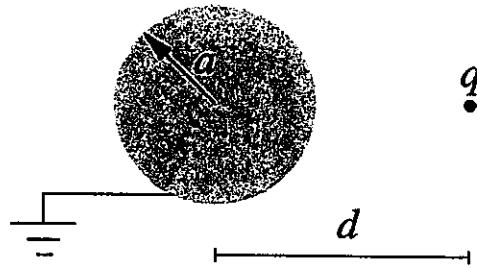
2. Find the capacitance of two concentric spherical metal shells with radii a and b . (25%)



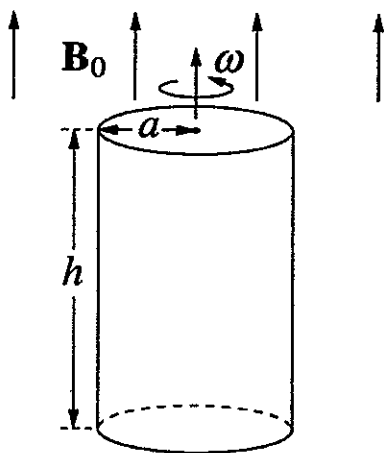
3. (25%) A point charge q is located at a distance d from the center of a conducting grounded sphere of radius $a < d$. Evaluate

- the electric potential φ over the whole space;
- the force on the point charge;
- the electrostatic energy of the system.

Answer the above questions also in the case of an isolated, uncharged conducting sphere.



4. (25%) A conducting cylinder of radius a and height $h \gg a$ rotates around its axis at constant angular velocity ω in a uniform magnetic field \mathbf{B}_0 , parallel to the cylinder axis.



- Evaluate the magnetic force acting on the conduction electrons, assuming $\omega = 2\pi \times 10^2 \text{ s}^{-1}$ and $B = 5 \times 10^{-5} \text{ T}$ (the Earth's magnetic field), and the ratio of the magnetic force to the centrifugal force. Assume that the cylinder is rotating in stationary conditions. Evaluate

Assume that the cylinder is rotating in stationary conditions. Evaluate

- the electric field inside the cylinder, and the volume and surface charge densities;
- the magnetic field \mathbf{B}_1 generated by the rotation currents inside the cylinder, and the order of magnitude of B_1/B_0 (assume $a \approx 0.1 \text{ m}$).