UNIVERSITY OF LEIPZIG
INSTITUTE FOR THEORETICAL PHYSICS
Department: Theory of Elementary Particles

TP2 2017

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List of problems 9

26. A dielectric sphere of radius a and dielectric constant ϵ_1 is placed in a dielectric liquid of infinite extent and dielectric constant ϵ_2. A uniform electric field $\mathbf{E}_0$ was originally present in the liquid.
Find the resultant electric field and electric displacement vectors inside and outside the sphere.
What is the polarisation vector $\mathbf{P}$ inside the sphere?
Give the result for the fields for the case of a spherical cavity of radius a (vacuum) in a dielectric medium with ε and an applied uniform field $\mathbf{E}_0$.
What are the polarization charges in that case?

27. Find the vector of magnetic induction $\mathbf{B}$ inside a quadratic filamentary wire (line current) with current I and side length of the square $2a$.
("inside" means inside the plane given by the wire)

28. Voluntary

    The figure shows the cross section of an infinitely long circular cylinder of radius $3a$ with an infinitely long cylindrical hole of radius a displaced so that its center is at a distance a from the center of the big cylinder. The solid part of the cylinder carries a current I, distributed uniformly over the cross section, and out from the plane of the paper.
    Find the magnetic induction at all points on the plane containing the axes of the cylinders.
    Determine $\mathbf{B}$ throughout the hole.