

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

TP2 2015

Lecturer: PD Dr. A. Schiller

List of problems 7

(19. and 20. required, use 21. to collect an additional point)

19. A surface charge density $\sigma(\theta) = \sigma_0 \cos \theta$ is glued to the surface of a spherical shell of radius R (σ_0 is a constant and θ is the polar angle). There is a vacuum, with no charges, both inside and outside of the shell.
Calculate the electrostatic potential and the electric field vector both inside and outside of the spherical shell.

20. A conducting sphere of radius a carrying a charge q is placed in a uniform electric field \mathbf{E}_0 .
Find the potential and the electric field vector at all points inside and outside of the sphere,
What is the dipole moment of the induced charge on the sphere?

21. Consider a sphere of radius R centered at the origin. Suppose a point charge q is put at the origin and this is the only charge inside or outside the sphere. Furthermore the potential is $\Phi = V_0 \cos \theta$ on the surface of the sphere. What is the electrostatic potential and the electric field vector both inside and outside the sphere?
Hint: Use superposition to take into account the potential of the point charge inside the sphere.