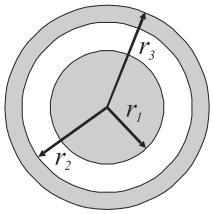
Gauss' Law

Basic Problems

1. Calculate the flux of a homogeneous electric field with magnitude 350 N/C through a circular area with radius 7.3 cm whose normal is tilted by 30° with respect to the direction of the field.
2. Using the formula for the electric field around a charged wire, calculate the flux through a cylinder with radius 2.5 cm and length 38 cm around a wire with a charge density of 320 nC/m. Compare the result to the one calculated with Gauss' law.
3. Calculate the flux of the electric field through a Gaussian surface which contains Q_1, but not Q_2, and the flux through a Gaussian surface which contains both charges.

4. A test charge 4.5 nC is placed at a distance of 1.5 cm from a straight wire 2.1 m long and carrying a charge of 4.3 µC. Calculate the mutual force between test charge and the wire.
5. Find a formal relation for the mutual attraction between two parallel, oppositely charged, identical plates. Calculate the force for two plates with area 150 cm² and charge ± 35 nC, which are 1.2 cm apart.
6. A *spherical capacitor* consists of a conducting sphere with radius r_1 in a concentric spherical shell with inner radius r_2 and outer radius r_3 (see figure). The sphere and the shell carry charges which are equal in magnitude but opposite in sign. Derive expressions for the electric field in the ranges $r < r_1$, $r_1 < r < r_2$, $r_2 < r < r_3$ and $r > r_3$. Graph the magnitude of the electric field vs. r.



Lösungen Grundaufgaben: 1. 5.1 N m²/C; 2. 13.7 kN m²/C; 3. + 110 N m²/C, – 110 N m²/C; 4. 11 mN; 5. 9.2 mN