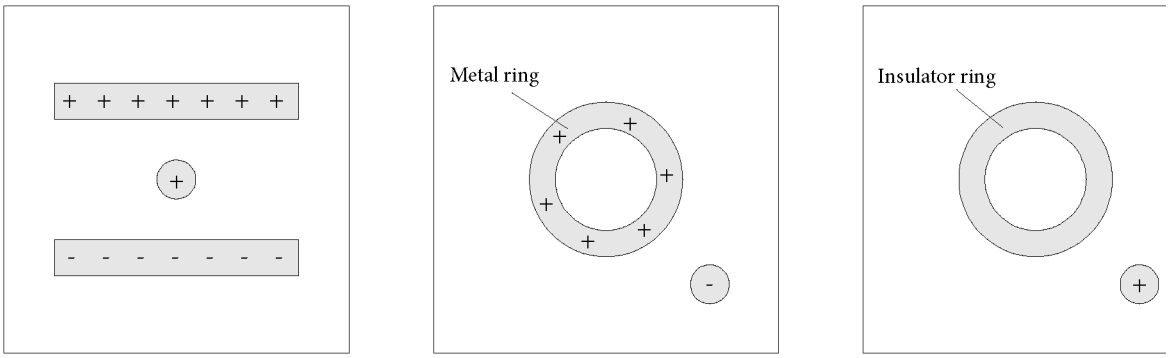
Electric Field

Basic Problems

1. Draw some field lines for the following charge distributions:



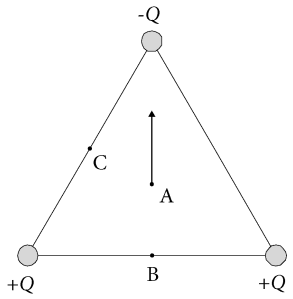
2. Calculate the magnitude of the electric field at 52 pm from a hydrogen nucleus.
3. Calculate the magnitude of the electric field halfway between two point charges of magnitude + 2 nC and + 3 nC, which are 10 cm apart. Determine the force acting on a test charge with magnitude 0.1 nC at this position. Redo the calculations for the case where one of the field-producing charges is negative.
4. A test charge of 1.5 nC is placed in the electric field of a copper cube at a point where the electric field has magnitude 2.5 kN/C. Calculate the force the test charge exerts on the cube. Give reasons for your answer.
5. An electron flies parallel to the earth's surface. Determine the magnitude and direction of the electric field close to the surface and discuss the result.
6. A small ball carrying a charge 0.5 nC is placed in a homogeneous field with magnitude 50 N/C. Find a point where the total electric field vanishes.
7. Four identical charges are placed at the corners of a square. Each of them creates an electric field with magnitude 15 N/C at the centre of the square. Find the direction and magnitude of the field vector at the centre of the square and at the centre of one of the square's sides.
8. The magnitude of the (homogeneous) electric field between two charged plates with area A and charges ± Q is given by

$$E = \frac{\sigma}{\varepsilon_0},$$

where $\sigma = Q/A$ is the charge density of the plates. Calculate the charge on plates with area 47 cm² for an electric field of magnitude 2.5 kN/C.

Supplementary Problems

9. Two point charges + Q and − 2 Q are placed at a distance d. Determine the points along the straight line connecting the two charges where the total electric field vanishes.
10. Two two-dimensional homogeneous fields with components (3|4) N/C and (5|2) N/C are superposed. Determine the magnitude of the resultant field vectors and their angle to the y-axis.
11. Three charges are placed at the corners of an equilateral triangle. The field vector in A caused by the negative charge only is given in the figure. Find the field vectors in A, B and C (1 cm for 1 N/C).



Solutions to Basic Problems: 2. 530 GN/C; 3. 3.6 kN/C (18 kN/C), 0.36 μN (1.8 μN); 4. 3.75 μN (actio = reactio); 5. 56 pN/C, downwards; 6. 0.3 m away; 7. 11 N/C; 8. 0.10 nC