

1. Complete the following sentences:
  - a) The smaller the distance between two charged particles is, the ..... (*greater / smaller*) is the electrical force between them.
  - b) The smaller the charges of two charged particles are, the ..... (*greater / smaller*) is the electrical force between them.
2. Given are two objects of charge  $q_1$  and  $q_2$ , whose centers are separated by the distance  $r$ . Complete the following sentences:
  - a) If  $q_1$  is tripled, without changing  $q_2$  and  $r$ , the electrical force between the charges changes by the factor .....
  - b) If both charges  $q_1$  and  $q_2$  are divided by two, without changing  $r$ , the electrical force between them changes by the factor .....
  - c) If  $r$  is multiplied by three, without changing  $q_1$  and  $q_2$ , the electrical force between the charges changes by the factor .....
  - d) If  $r$  is divided by four, without changing  $q_1$  and  $q_2$ , the electrical force between the charges changes by the factor .....
3. The distance between two protons in the atomic nucleus amounts to about  $2.0 \cdot 10^{-15}$  m. Since they are both positively charged they repel each other.  
What's the magnitude of the Coulomb force between them?  
  
*Information:* Atomic nuclei don't fall apart, because they are being held together by the nuclear force which acts between nucleons. The nuclear force is larger than the electric repulsion, but only acts at very short distances, within the atomic nucleus.
4. Two equal point charges are separated by a distance of  $r = 2.5$  cm and repel each other with the force  $F = 0.046$  N.  
What is the magnitude of their charges  $Q$ ?
5. Two tiny metal spheres of the same size carry charges of  $+3.0 \cdot 10^{-8}$  C and  $-2.0 \cdot 10^{-8}$  C respectively. The attractive force between them amounts to 7.8 mN.
  - a) What's the distance between the two little spheres?
  - b) The two spheres shortly touch, are separated again, and then placed at the same distance as before. What is the magnitude of the force which acts between them now?
6. *difficult* Two point charges  $Q_1 = +Q$  und  $Q_2 = +4Q$  are separated by the distance  $r$ . A third small charge  $Q_3$  shall be placed on the straight line which runs through the charges  $Q_1$  and  $Q_2$ , in such a way that it will be at rest (at equilibrium).  
Where is this point of equilibrium?

