

Chapter 32 Electrostatics

Coulomb's Law

Consider a pair of charged particles separated by a distance d . If the distance between the particles is multiplied by 4, how will the electrostatic force between the particles change?

1. Read and Understand

What information are you given?

Two charged particles, q_1 and q_2 , are a distance d apart.

An electrostatic force, F , exists between the particles.

The final distance equals $4d$.

2. Plan and Solve

What unknown are you trying to calculate?

Electrostatic force after the distance changes, $F_{\text{new}} = ?$

What mathematical relationship can you use to find the unknown?

Coulomb's law: $F = k \frac{q_1 q_2}{d^2}$

Apply this law to find the new force after the distance changes.

$$F_{\text{new}} = k \frac{q_1 q_2}{(4d)^2} = k \frac{q_1 q_2}{16d^2} = \left(\frac{1}{16}\right)F$$

3. Look Back and Check

Is your answer reasonable?

Yes, the distance increased by a factor of 4, so the force should decrease by a factor of 4 squared, or 16.

Math Practice

On a separate sheet of paper, solve the following problems. Consider a pair of particles separated by a distance d .

1. If the charge of each particle tripled and the distance also tripled, how would the electrostatic force between the particles change?
2. If the charge of one particle doubled and the charge of the other particle tripled, how would the electrostatic force between the particles change?
3. If the charge of one particle were reduced to one-half the original charge and the distance between the charges were multiplied by 2, how would the electrostatic force between the particles change?