

ACTIVITY IN ELECTRICITY AND MAGNETISM  
Coulomb's Law

Before You Begin the Activity

To be familiar with the electrostatic force magnitude direction and the parameters affecting this force using PhET simulation open the following link and play with it.

[https://phet.colorado.edu/sims/html/coulombs-law/latest/coulombs-law\\_en.html](https://phet.colorado.edu/sims/html/coulombs-law/latest/coulombs-law_en.html)

**Objectives**

Obtain the value of the electric constant, k.

**Theoretical Background**

Coulomb's Law: "The magnitude of the electric force that a particle exerts on another is directly proportional to the product of their charges and inversely proportional to the square of the distance between them." Mathematically, the magnitude of this electrostatic force  $F_E$  acting on two charged particles ( $q_1, q_2$ ) is expressed as:

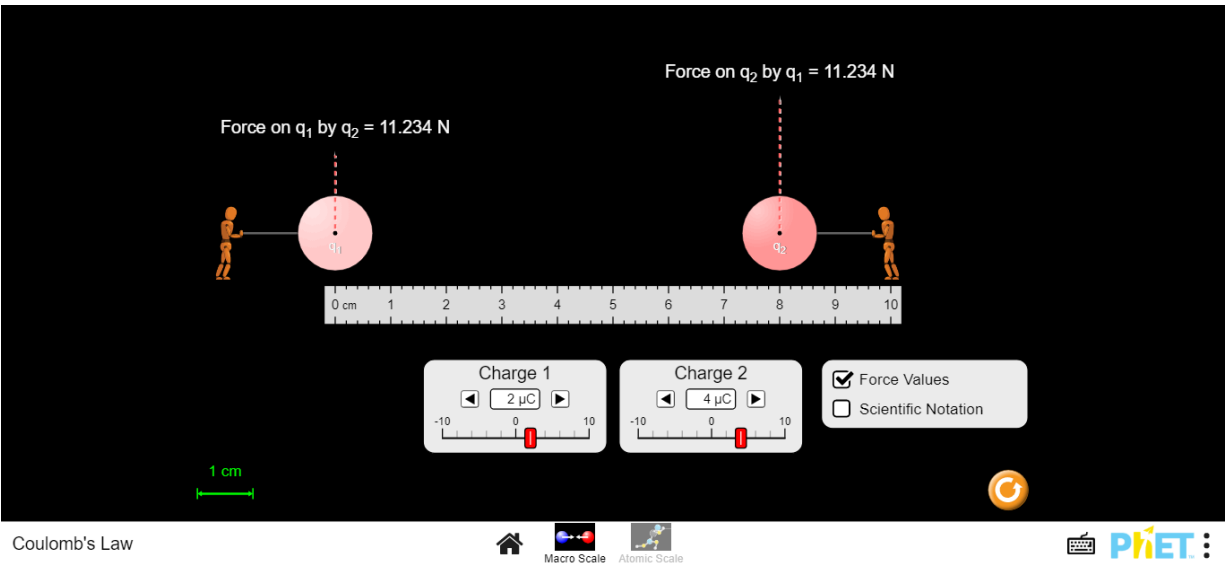
$$F_E = k \frac{q_1 q_2}{r^2}$$

Where  $r$  is the separation distance between the charged objects and  $k$  is a constant of proportionality, called the Coulomb constant,  $k = 9.0 \times 10^9 \text{ Nm}^2/\text{C}^2$ .

**Procedure**

1. Click on the following link and fix the charge  $q_1=2\mu\text{C}$  and  $q_2=4\mu\text{C}$  write their values in table 1.

[https://phet.colorado.edu/sims/html/coulombs-law/latest/coulombs-law\\_en.html](https://phet.colorado.edu/sims/html/coulombs-law/latest/coulombs-law_en.html)



2. Change the distance between the two charges as shown in the Table 1.
3. Record the force value for each distance in Table 1

Table 1

$q_1=$	$q_2=$	$q_1q_2=$	
$r \text{ (cm)}$	$r^2 \text{ (m}^2\text{)}$	$F_E \text{ (N)}$	$\frac{F_E(r^2)}{(q_1q_2)}$
10			
9			
8			
7			
6			
5			
4			
3			
		Average:	
			=k

Calculate the percentage error in k ( $k_{\text{known}}=9.0 \times 10^9 \text{ Nm}^2/\text{C}^2$ )

Calculations:

Answer the following questions concisely.

- Does the Coulombs Law represent a linear expression? Why?
- Does changing the value of the charges affect the value of k?
- Which of the two factors affects the magnitude of the electrostatic force  $F_E$ : the magnitude of the charges or the separation distance?