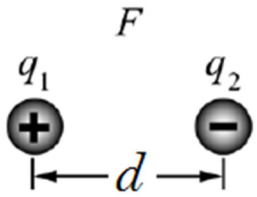
Coulomb's Law Calculations Name _____ Block_____ Date_____

In this assignment, you will work with Coulomb's law. Coulomb's law represents an inverse square relationship. When two charges q_1 and q_2 are separated by a distance (d), there exists an electrical force between them that is given by:



$$F = K\frac{q_1 q_2}{d^2}$$

Constant: $K = 9 \times 10^9\ \text{N m}^2/\text{c}^2$; Force (N); Charges (C); Distance (m)

F equals the force in Newtons and ***K*** is a constant equal to 9 x 10^9 N·m^2/C^2. The units of q_1 and q_2 are the coulombs (*C*). Distance is given in meters.

Here are some important points about the relationships of the variables in Coulomb's law:

- *Force is inversely proportional to the square of the distance between the charges. Therefore, if the distance increases by a factor of 2, the force decreases by a factor of 4.*
- *Force is proportional to the strength of each charge.*
- *When the two charges have the same sign (positive or negative), the force between them is repulsive because like charges repel.*
- *When the charges have opposite signs, the force between them is attractive because unlike charges attract.*

Example:

A 0.001 coulomb charge and a 0.002 coulomb charge are 2 meters apart. Calculate the force between them.

Given	**Solution**
The charges have magnitudes of 0.003 C and 0.005 C. The charges are 2 meters apart.	$F = (9\times10^9\ \text{N}\cdot\text{m}^2/\text{C}^2)\frac{(0.001\ \text{C})(0.002\ \text{C})}{(2\ \text{m})^2}$ $F = 4500\ \text{N}$ The force is 4500 newtons.
Looking for The force between the charges.	
Relationships $F = k\frac{q_1 q_2}{r^2}$	

Consider the electric force between a pair of charged particles a certain distance apart. By Coulomb's Law:

1. If the charge of one of the particles is doubled, the force is-

   (unchanged) (halved) (doubled) (quadrupled)

2. If, instead, the charge of both particles is doubled, the force is-

   (unchanged) (halved) (doubled) (quadrupled)

3. If, instead, the distance between the particles is doubled, the force becomes-

   (one fourth) (half) (double) (4 times)

4. If the distance is halved and the charges of both particles are doubled, the force is _____ as great.
5. What happens to the force between two charges if the distance between them is cut in half?
6. What happens to the force between two charges if the magnitude of one charge is doubled?
7. What happens to the force between two charges if the magnitude of both charges is doubled and the distance between them is cut in half?

Problems: *Show your work (G.U.E.S.S.) to receive full credit, and make sure every answer has a unit.*

1. Two particles, each with a charge of 1 C, are separated by a distance of 1 meter. What is the force between the particles?

2. What is the force between a 3 C charge and a 2 C charge separated by a distance of 5 meters?

3. Calculate the force between a 0.006 C charge and a 0.001 C charge 4 meters apart.

4. Calculate the force between a 0.05 C charge and a 0.03 C charge 2 meters apart.

5. Two particles are each given a charge of 5×10^{-5} C. What is the force between the charged particles if the distance between them is 2 meters?

6. The force between a pair of charges is 100 Newtons. The distance between the charges is 0.01 meter. If one of the charges is 2×10^{-10} C, what is the strength of the other charge?

7. Two equal charges separated by a distance of 1 meter experience a repulsive force of 1,000 Newtons. What is the strength in coulombs of each charge?

8. The force between a pair of 0.001 C charges is 200 N. What is the distance between them?

9. The force between two charges is 1,000 N. One has a charge of 2×10^{-5} C, and the other has a charge of 5×10^{-6} C. What is the distance between them?