

Name: ANSWER KEY

Score: _____

Coulomb's law in electrical theory states that the force F of attraction between two oppositely charged particles varies directly as the product of the magnitudes Q_1 and Q_2 of the charges and inversely as the square of the distance d between the particles.

(a) Find a formula for F in terms of Q_1 , Q_2 , d , and a coefficient of variation k .

$$\begin{array}{l} F \propto Q_1 Q_2 \\ F \propto \frac{1}{d^2} \end{array} \quad \therefore \quad \boxed{F = k \frac{Q_1 Q_2}{d^2}}$$

(b) What is the effect on F of reducing the distance between the particles by a factor of one-fourth?

$$F' = k \frac{Q_1' Q_2'}{(d')^2} = k \frac{Q_1 Q_2}{(\frac{1}{4}d)^2} = k \frac{Q_1 Q_2}{\frac{1}{16}d^2} = 16 \left(k \frac{Q_1 Q_2}{d^2} \right) = 16 F$$

$$\begin{cases} Q_1' = Q_1 \\ Q_2' = Q_2 \\ d' = \frac{1}{4}d \end{cases}$$

Increases F by a factor of 16