

Unit I - Worksheet 3: Coulomb's Law Key

1. Given the mathematical representation of Coulomb's Law, $F = k \frac{q_1 q_2}{r^2}$, where $k = 9.0 \times 10^9 \text{ Nm}^2/\text{C}^2$, describe in words the relationship among electric force, charge, and distance.

The electric force is proportional to the product of the charges and is inversely proportional to the square of the distance between the charges.

2. By how much does the electric force between a pair of charged bodies diminish when their separation is doubled? tripled?

$$F_1 = \frac{k}{r^2} \quad F_2 = \frac{k}{(2r)^2} = \frac{k}{4r^2} \quad F_2 = \frac{1}{4}F_1 \qquad F_1 = \frac{k}{r^2} \quad F_2 = \frac{k}{(3r)^2} = \frac{k}{9r^2} \quad F_2 = \frac{1}{9}F_1$$

The force is 1/4th as much.

The force is 1/9th as much.

3. Two positive charges of $6.0 \times 10^{-6} \text{ C}$ are separated by 0.50 m. Draw a force diagram for each of the charges, considering only electrostatic forces. What is the magnitude of the force between the charges? Is this force repulsive or attractive?



$$F = k \frac{q_1 q_2}{r^2} \quad F = \frac{9.0 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2} (6.0 \times 10^{-6} \text{ C})(6.0 \times 10^{-6} \text{ C})}{(.50\text{m})^2} = 1.3\text{N}$$

Like charge repells, so the force is repulsive.

4. A negative charge of $2.0 \times 10^{-4} \text{ C}$ and a positive charge of $8.0 \times 10^{-4} \text{ C}$ are separated by 0.30 m. What is the magnitude of the force between the charges? Is this force repulsive or attractive?

$$F = k \frac{q_1 q_2}{r^2} \quad F = \frac{9.0 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2} (-2.0 \times 10^{-4} \text{ C})(8.0 \times 10^{-4} \text{ C})}{(.30\text{m})^2} = 1600\text{N}$$

Opposite charges attract, so the force is attractive.

5. A young man accumulates a charge q_1 of $+2.0 \times 10^{-5} \text{ C}$ while sliding out of the front seat of a car. His girlfriend, who had been waiting in the wind, has picked up some extra electrons and now has a charge q_2 of $-8.0 \times 10^{-5} \text{ C}$.

Draw a sketch of the situation. Estimate the magnitude of the electrical force that each person exerts on the other when separated by a distance of 6.0 m. Is the force attractive or repulsive?

$$F = k \frac{q_1 q_2}{r^2} \quad F = \frac{9.0 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2} (2.0 \times 10^{-5} \text{ C})(-8.0 \times 10^{-5} \text{ C})}{(6.0\text{m})^2} = .40\text{N}$$

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Wenbin Ji



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Commission,1992 **Statistical Aspects of Water Quality Monitoring** A.H. El-Shaarawi,R.E. Kwiatkowski,2011-09-22
This volume contains selected papers from the Workshop on the Statistical Aspects of Water Quality Monitoring held on October 7 10 1985 at the National Water Research Institute in Burlington Ontario Canada The prime objective of the Workshop was to generate interaction between the statistical community and scientists working in the area of Water Quality Monitoring To this end topics covered in this Workshop fall into two categories 1 Methods Development and 2 the Imaginative Application of Existing Methodologies Subjects covered include Time Series Estimation of Loading Clustering Model Development Censoring Data Analysis Quality Control and Data Acquisition In the area of environmental sciences statistical applications are still in their infancy with few attempts to systematically develop techniques dealing with environmental issues The publication of this book is one step towards identifying appropriate statistical techniques and diagnosing problems in Water Quality Monitoring which require new statistical methodologies The papers presented in this volume represent international expertise consolidating detailed information on both conventional and new methods

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