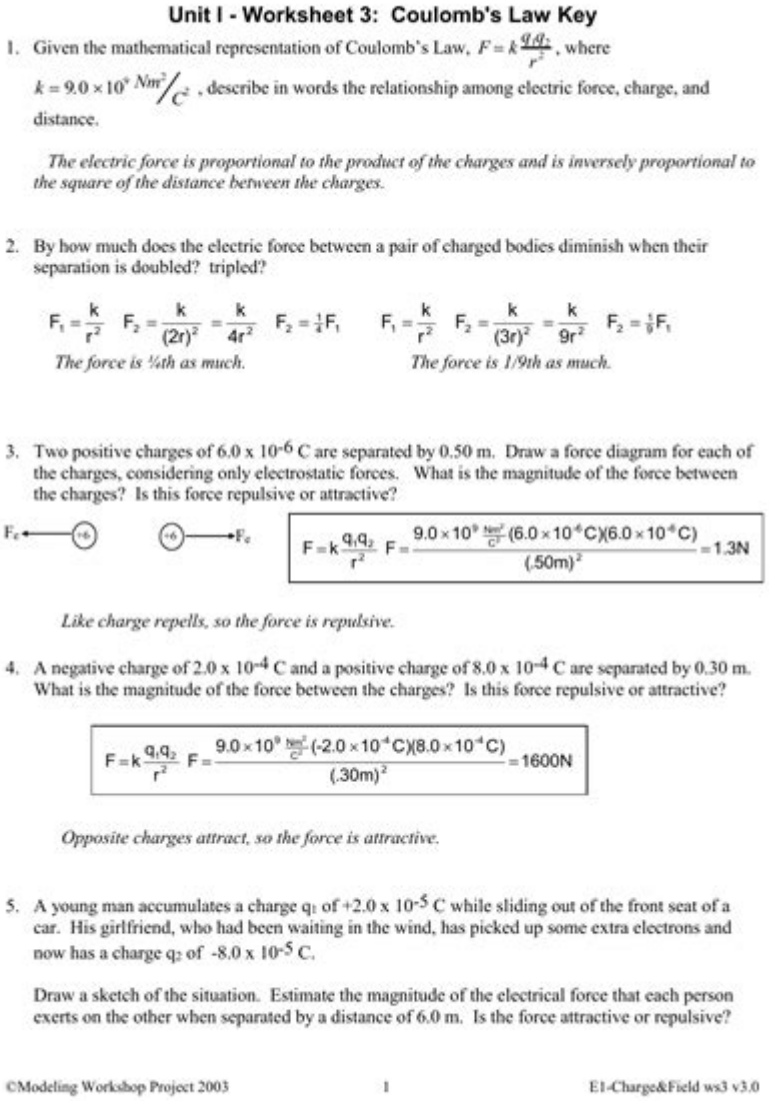
Coulombs Law Practice 152 Worksheet Answers



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 $k = 9.0 \times 10^9\ Nm^2/C^2$, 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?

   $F_1 = \frac{k}{r^2}$ $F_2 = \frac{k}{(2r)^2} = \frac{k}{4r^2}$ $F_2 = \frac{1}{4}F_1$ — *The force is ¼th as much.*

   $F_1 = \frac{k}{r^2}$ $F_2 = \frac{k}{(3r)^2} = \frac{k}{9r^2}$ $F_2 = \frac{1}{9}F_1$ — *The force is 1/9th as much.*

3. Two positive charges of 6.0 x 10^{-6} 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?

   $F_e \leftarrow (+6)$ $(+6) \rightarrow F_e$

   $F = k\frac{q_1 q_2}{r^2}$ $F = \frac{9.0\times10^9 \frac{Nm^2}{C^2}(6.0\times10^{-6}C)(6.0\times10^{-6}C)}{(.50m)^2} = 1.3N$

   Like charge repells, so the force is repulsive.

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

   $F = k\frac{q_1 q_2}{r^2}$ $F = \frac{9.0\times10^9 \frac{Nm^2}{C^2}(-2.0\times10^{-4}C)(8.0\times10^{-4}C)}{(.30m)^2} = 1600N$

   Opposite charges attract, so the force is attractive.

5. A young man accumulates a charge q_1 of +2.0 x 10^{-5} 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 x 10^{-5} 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?

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Coulomb's law practice 152 worksheet answers are essential for students and individuals studying electrostatics. Coulomb's law describes the force between two charged objects, and mastering the concepts through practice worksheets can significantly enhance understanding. This article will provide insights into Coulomb's law, discuss the types of questions often found in practice worksheets, and guide readers on how to effectively solve them. We will also provide sample problems and their solutions to help reinforce learning.

Understanding Coulomb's Law

Coulomb's law is a fundamental principle in physics that quantifies the electrostatic force between charged particles. The law states that:

- The magnitude of the electrostatic force F between two point charges is directly proportional to the product of the absolute values of the charges q_1 and q_2.
- The force is inversely proportional to the square of the distance r between the charges.

The mathematical expression of Coulomb's law is given by:

$$ F = k \frac{|q_1 \cdot q_2|}{r^2} $$

where:
- F is the magnitude of the electrostatic force,
- k is Coulomb's constant ($8.99 \times 10^9 \, N \cdot m^2/C^2$),
- q_1 and q_2 are the magnitudes of the charges,
- r is the distance between the centers of the two charges.

Understanding this equation is crucial for solving problems that involve Coulomb's law.

Types of Questions in Coulomb's Law Practice Worksheets

Coulomb's law practice worksheets often include a variety of question types aimed at testing different aspects of understanding. Common question types include:

- **Calculation Problems:** These require students to compute the force between two charges given their magnitudes and the distance between them.
- **Conceptual Questions:** These questions test the understanding of the principles behind Coulomb's law, such as the effects of changing charge magnitudes or distances.
- **Vector Problems:** Questions that require students to consider the direction of the forces involved, particularly when dealing with multiple charges.
- **Real-world Applications:** Problems that relate Coulomb's law to practical scenarios, such as the behavior of charged particles in electric fields.

Solving Coulomb's Law Practice Problems

To effectively solve problems related to Coulomb's law, follow these general steps:

Step 1: Identify the Charges

Determine the magnitudes of the charges involved in the problem. Be mindful of the signs of the charges, as they will affect the direction of the force.

Step 2: Measure the Distance

Find the distance between the centers of the two charges. If the problem provides multiple distances or configurations, ensure to use the correct one.

Step 3: Apply Coulomb's Law Formula

Insert the values of the charges and the distance into the Coulomb's law formula. Remember to use absolute values for the charges when calculating the force.

Step 4: Determine the Direction of the Force

If applicable, determine the direction of the force. Like charges repel each other, while opposite charges attract.

Step 5: Solve and Check Units

Perform the calculations, ensuring that your final answer is in the correct units (Newtons for force).

Sample Problems and Solutions

Let’s look at a couple of sample problems to illustrate the application of Coulomb's law.

Sample Problem 1

Given:
- Charge $q_1 = 3 \, \mu C$ (microcoulombs)
- Charge $q_2 = -2 \, \mu C$
- Distance $r = 0.5 \, m$

Find the electrostatic force between the two charges.

Solution:
1. Convert microcoulombs to coulombs:
- $q_1 = 3 \times 10^{-6} \, C$
- $q_2 = -2 \times 10^{-6} \, C$

2. Use Coulomb's law:
$$
F = k \frac{|q_1 \cdot q_2|}{r^2} = (8.99 \times 10^9) \frac{|3 \times 10^{-6} \cdot -2 \times 10^{-6}|}{(0.5)^2}
$$
$$
F = (8.99 \times 10^9) \frac{6 \times 10^{-12}}{0.25} = (8.99 \times 10^9) \cdot 2.4 \times 10^{-11} \approx 216.6 \, N
$$

3. Since q_1 and q_2 have opposite signs, the force is attractive.

Sample Problem 2

Given:
- Two charges $q_1 = 4 \, C$ and $q_2 = 5 \, C$ are $1.0 \, m$ apart.
- Calculate the force between them.

Solution:
1. Apply Coulomb's law:
$$
F = k \frac{|q_1 \cdot q_2|}{r^2} = (8.99 \times 10^9) \frac{|4 \cdot 5|}{(1)^2}
$$
$$
F = (8.99 \times 10^9) \cdot 20 \approx 1.798 \times 10^{11} \, N
$$

2. Since both charges are positive, the force is repulsive.

Conclusion

Coulomb's law practice 152 worksheet answers are invaluable for reinforcing understanding of electrostatic forces. By mastering the principles and practicing various types of problems, students can develop a solid foundation in electrostatics. Whether through calculation problems, conceptual questions, or real-world applications, engaging with Coulomb’s law will pave the way for more advanced studies in physics and engineering. For further practice, students are encouraged to seek additional worksheets and resources to enhance their skills.

Frequently Asked Questions

What is Coulomb's Law and how is it applied in practice problems?

Coulomb's Law describes the force between two charged objects, stating that the force is directly proportional to the product of the magnitudes of the charges and inversely proportional to the square of the distance between them. In practice problems, it is applied to calculate the electric force acting between charged particles using the formula F = k |q1 q2| / r^2.

How do you interpret the answers in a Coulomb's Law worksheet like practice 152?

In a Coulomb's Law worksheet, each answer typically represents the magnitude and direction of the force between charged objects. Positive values indicate repulsive forces, while negative values indicate attractive forces. It's crucial to also consider the signs of the charges involved.

What types of problems can be found in the Coulomb's Law practice 152 worksheet?

The practice 152 worksheet may include problems such as calculating the force between two point charges, determining the net force on a charge due to multiple other charges, and analyzing electric fields created by charged particles.

What units are commonly used in Coulomb's Law calculations in practice worksheets?

In Coulomb's Law calculations, the force is typically measured in newtons (N), charge in coulombs (C), and distance in meters (m). The constant k (Coulomb's constant) is approximately 8.99 x 10^9 N m²/C².

How can one verify the answers provided in the Coulomb's Law practice 152 worksheet?

To verify answers in the Coulomb's Law practice 152 worksheet, you can re-calculate the forces using the provided formulas, check with known values and concepts, or cross-reference with reliable physics textbooks or online resources to ensure consistency.

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