

coulombs law 152 worksheet answers

Coulomb's Law 152 worksheet answers are an essential resource for students studying electrostatics and the fundamental principles of electric forces. Understanding Coulomb's Law is crucial for grasping the interactions between charged particles, which form the basis of many concepts in physics and chemistry. This article will explore Coulomb's Law, its applications, and how to effectively work through problems found in the "Coulomb's Law 152" worksheet.

What is Coulomb's Law?

Coulomb's Law describes the force between two charged objects. Formulated by Charles-Augustin de Coulomb in the 18th century, the law states that:

1. The force (F) between two point charges (q_1 and q_2) is directly proportional to the product of the magnitudes of the charges.
2. The force is inversely proportional to the square of the distance (r) between the charges.

Mathematically, it is expressed as:

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

where:

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

Applications of Coulomb's Law

Coulomb's Law is not just a theoretical concept but has several practical applications, including:

- **Electrostatics:** Understanding forces between charged objects, such as in the design of capacitors.
- **Physics experiments:** Used in laboratory settings to measure forces between charged particles.
- **Electrical engineering:** Fundamental in the analysis of circuits and understanding charge distribution.
- **Chemistry:** Explains the interactions between ions in ionic compounds.

Solving Problems with Coulomb's Law

When tackling problems related to Coulomb's Law, such as those you might find on a "Coulomb's Law 152" worksheet, it's essential to follow a systematic approach. Here's how to effectively solve these problems:

Step 1: Identify the Charges

Start by identifying the values and types of the charges involved. Charges can be positive or negative, and their signs will determine the nature of the force (attractive or repulsive).

Step 2: Measure the Distance

Next, determine the distance (r) between the two charges. Make sure to use consistent units (meters, in SI units) to avoid calculation errors.

Step 3: Apply Coulomb's Law

Utilize the formula to calculate the force:

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

Insert the known values of q_1 , q_2 , and r into the equation. Don't forget the value of Coulomb's constant (k).

Step 4: Determine the Direction of the Force

Forces between like charges are repulsive (pushing apart), while forces between opposite charges are attractive (pulling together). Mark the direction of the force based on the signs of the charges.

Step 5: Units and Final Answer

Finally, ensure that your answer is in the correct units (Newtons for force) and consider significant figures based on the precision of the given values.

Example Problems from the Coulomb's Law 152 Worksheet

To better understand how to apply Coulomb's Law, let's go through a couple of example problems that might appear in a typical "Coulomb's Law 152" worksheet.

Example 1: Calculating the Force Between Two Charges

Problem: Calculate the force between a $(3 \text{ } \mu\text{C})$ charge and a $(5 \text{ } \mu\text{C})$ charge separated by (0.1 m) .

Solution:

1. Convert microcoulombs to coulombs:

$$- q_1 = 3 \text{ } \mu\text{C} = 3 \times 10^{-6} \text{ C}$$

$$- q_2 = 5 \text{ } \mu\text{C} = 5 \times 10^{-6} \text{ C}$$

2. Distance $(r = 0.1 \text{ m})$.

3. Apply Coulomb's Law:

$$F = k \frac{q_1 \cdot q_2}{r^2} = (8.99 \times 10^9) \frac{(3 \times 10^{-6}) \cdot (5 \times 10^{-6})}{(0.1)^2}$$

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$$F = (8.99 \times 10^9) \cdot \frac{15 \times 10^{-12}}{0.01} = 1348.5 \text{ N}$$

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4. The force is repulsive since both charges are positive.

Example 2: Force Between Opposite Charges

Problem: Calculate the force between a $(-2 \text{ } \mu\text{C})$ charge and a $(4 \text{ } \mu\text{C})$ charge separated by (0.5 m) .

Solution:

1. Convert charges:

$$- (q_1 = -2 \text{ } \mu\text{C} = -2 \times 10^{-6} \text{ C})$$

$$- (q_2 = 4 \text{ } \mu\text{C} = 4 \times 10^{-6} \text{ C})$$

2. Distance $(r = 0.5 \text{ m})$.

3. Apply Coulomb's Law:

$$\begin{aligned} F &= k \frac{|q_1 \cdot q_2|}{r^2} = (8.99 \times 10^9) \frac{|-2 \times 10^{-6} \cdot 4 \times 10^{-6}|}{(0.5)^2} \\ &= 287.68 \text{ N} \end{aligned}$$

$$F = (8.99 \times 10^9) \cdot \frac{8 \times 10^{-12}}{0.25} = 287.68 \text{ N}$$

4. The force is attractive since one charge is negative and the other is positive.

Common Mistakes to Avoid

When working on problems related to Coulomb's Law, students often make some common errors:

- **Ignoring signs:** Always consider the nature of the charges when determining the direction of the force.
- **Unit conversion:** Ensure all measurements are in SI units before performing calculations.
- **Forgetting Coulomb's constant:** Remember to include k in your calculations to obtain the correct force value.

Conclusion

Understanding Coulomb's Law 152 worksheet answers is essential for mastering electrostatic concepts. By following a systematic approach to solve problems, understanding the underlying principles, and avoiding common pitfalls, students can confidently navigate through their coursework. Mastery of Coulomb's Law not only aids in academic success but also builds a strong foundation for future studies in physics and engineering.

Frequently Asked Questions

What is Coulomb's Law and how is it applied in the 152 worksheet?

Coulomb's Law describes the electrostatic force between two charged objects. It states 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 their centers. In the 152 worksheet, it is applied to calculate forces between various charge configurations.

What are common mistakes to avoid when solving Coulomb's Law problems in the 152 worksheet?

Common mistakes include forgetting to convert units correctly, neglecting the direction of the force (attraction vs. repulsion), and misapplying the formula by using incorrect values for charge or distance.

How do you calculate the net force acting on a charge using Coulomb's Law in the 152 worksheet?

To calculate the net force, apply Coulomb's Law to each pair of charges to find their individual forces, then use vector addition to combine these forces, taking into account their directions.

What is the significance of the constant 'k' in Coulomb's Law as shown in the 152 worksheet?

The constant 'k', known as Coulomb's constant, is approximately $8.99 \times 10^9 \text{ N m}^2/\text{C}^2$. It quantifies the strength of the electrostatic force in the equation and is crucial for calculating force accurately.

Can Coulomb's Law be used for point charges only, as shown in the 152 worksheet?

Yes, Coulomb's Law is primarily applicable to point charges. However, it can also be used for spherical charge distributions where the total charge can be treated as concentrated at a point at the center.

What concepts should be reviewed before tackling the 152 worksheet on Coulomb's Law?

Before tackling the worksheet, it is helpful to review basic concepts of electric charge, the principle of superposition, vector addition, and the concept of electric fields.

How does the distance between charges affect the force calculated in the 152 worksheet?

According to Coulomb's Law, as the distance between two charges increases, the force of attraction or repulsion decreases. Specifically, the force is inversely proportional to the square of the distance, meaning that doubling the distance results in a force that is one-fourth as strong.

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