Phy 211

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Physics Solver Program Report

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Introduction

The aim of this report is to provide an overview and analysis of a specialized program designed to solve various problems related to fundamental electrical physics concepts, including Coulomb's Law, Electric Field, Electric Potential, Ohm's Law, and Electric Current. This program serves as a valuable tool for students, educators, and professionals seeking efficient solutions to complex electrical problems.

Program Overview

The developed software is an interactive and user-friendly application that incorporates algorithms and formulas related to electrical physics principles. It operates as a problem-solving platform, allowing users to input relevant parameters and obtain accurate solutions for various scenarios.

Features:

Coulomb's Law Solver

The program computes the electrostatic force between two point charges based on Coulomb's Law, utilizing the formula F = k * (q1 * q2) / r^2, where F represents the force, k is Coulomb's constant, q1 and q2 denote the charges, and r is the distance between charges.

We have a problem:

Problem (3): What is the magnitude of the force that a $25\ \mu\text{C}$-charge exerts on a $-10\ \mu\text{C}$ charge $8.5\ \text{cm}$ away? (Take $k = 9 \times 10^9\ \frac{\text{N.m}^2}{\text{C}^2}$)

Scientific way:

$$F = k*q1*q2/r^2$$

$$= (9\times10^{9})(8.5\times10^{-2}\text{m})^{2}\ (25\times10^{-6}\text{C})(10\times10^{-6}\text{C})$$

$$= 311.073\text{N}$$

Our Program way:

```
*** Coulomb's Law Solver ***
Enter the value of Q1 (charge 1): 25e-6
Enter the value of Q2 (charge 2): -10e-6
Enter the distance between charges (r): 8.5e-2
The force between charges is: 311.07266435986156 Newtons
in -ve x direction
```

Electric Field Solver:

Users can determine the electric field intensity at a specific point in space due to one or more point charges or continuous charge distributions. The software employs the formula E = k * (Q / r^2) for point charges or integrates over charge distributions to calculate the electric field.

We have a problem :

Problem (1): What is the magnitude and direction of the electric field due to a point charge of $20\mu C$ at a distance of 1 meter away from it?

Scientific way:

$$E=k*q/r^2$$

$$=(9\times10^{9})(20\times10^{-6})/1^2$$

$$=180000N/C$$

Our Program way:

```
*** Electric Field Solver ***
Enter the value of charge (Q): 20e-6
Enter the distance from the charge (r): 1
The electric field is: 180000.00000000003 Newtons/Coulomb
```

Electric Potential Solver:

This feature enables users to calculate the electric potential at a given point in an electric field. It utilizes the formula V = (W / Q), where Q denotes charge, and W signifies the Work.

We Have a Problem:

Calculate the electric potential at a point in space due to a point charge of Q=4μC located 3 meters away.

Scientific way:

$$V=k*Q/r$$

$$=(8.99\times10^{9}\ N\ m^2/C^2)\times(4\times10^{-6}\ C)/3$$

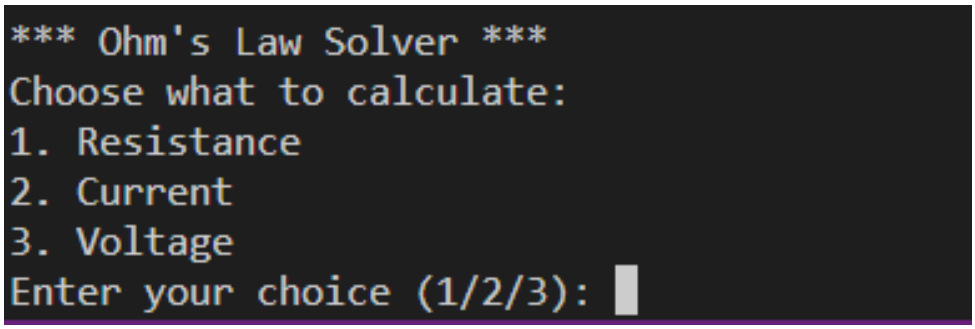
= 11.987kV= 11986.666666666666

Our Program way:

```
Enter your choice (1/2/3/4/5): 3
Enter the charge (in Coulombs): 4e-6
Enter the distance from the charge (in meters): 3
The electric potential at a distance of 3.0 meters from the charge is: 11986.666666666666 volts
```

Ohm's Law Calculator:

The program allows users to solve problems related to Ohm's Law (V = I * R), where V is voltage, I is current, and R is resistance. Users can input any two parameters to calculate the third.



Scientific way:

V=IR

R=V/I

I = V/R

We have a problem:

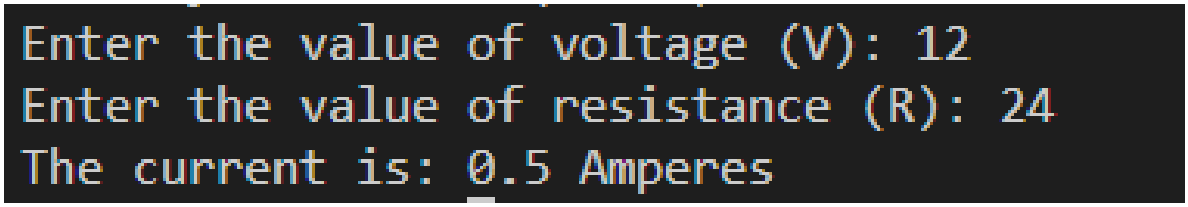
A potential difference across 24 Ω resistor is 12 V. What is the current through the resistor?

Solution

V = 12 V and R = 24 Ω

Current, I = ?

From Ohm's law, I = V/R = 12/24 = 0 .5 A



Electric Current Solver:

For various circuit configurations, the software computes electric current using the Formula : I= Q/t . It assists in analyzing complex circuits and determining the magnitude and direction of current flow.

Scientific way:

If a net electric charge (Q) flows through a cross section of conductor in time t, then:

$$\text{Electric Current}(I) = \text{Net charge}(Q) / \text{Time}(t)$$

Or, $I = Q/t$

Where , (I) is electric current , (Q) is net charge and (t) is time in second.

WE Have a problem:

Example 1: Find the amount of electric charge flowing through the circuit if an electric current of 5 A is drawn by an electric appliance for 5 minute.

Solution:

Given, electric current (I) = 5 A

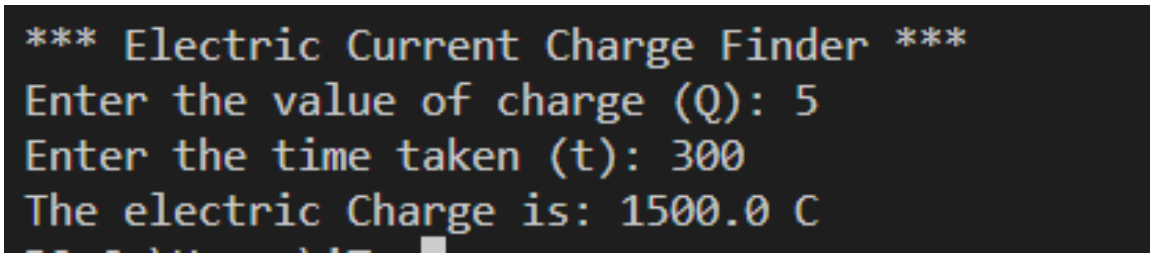
Time (t) = 5 minute $= 5 \times 60 = 300 = 5 \times 60 = 300$ s

Electric charge (Q) =?

We know, $I = Q/t$

Or, $Q = I \times t$

Or, $Q = 5A \times 300s = 1500C$



Applications:

Educational Use: **This program serves as an invaluable educational tool for students studying electrical physics concepts, providing step-by-step solutions and aiding in understanding fundamental principles.**

Professional Application: **Engineers, physicists, and professionals in the field of electronics and electrical engineering can use this program to efficiently solve problems encountered in their work.**

Conclusion:

In conclusion, the development of this specialized program significantly aids in solving problems related to Coulomb's Law, Electric Field, Electric Potential, Ohm's Law, and Electric Current. Its user-friendly interface and accurate calculations make it an essential tool for both educational and professional purposes within the realm of electrical physics.

Future Developments:

Future iterations of the program may include additional functionalities, improved visualization tools, and compatibility with various operating systems to enhance its usability and expand its applications further.

References:

The algorithms and formulas utilized in the program are based on established principles and equations from reputable physics and electrical engineering textbooks and resources.

This report serves as an overview of the capabilities and significance of the specialized program designed for solving electrical physics problems, offering a glimpse into its functionalities and potential applications.