

GROUP-1, TEAM -3

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```
import numpy as np
```

```
import matplotlib.pyplot as plt
```

```
from scipy.stats import linregress
```

```
def calculate_plancks_constant():
```

```
    """
```

```
    This function calculates Planck's constant from photoelectric effect data.
```

```
    User inputs frequencies and corresponding stopping potentials, and the program  
    performs linear regression to determine h.
```

```
    """
```

```
    print("Photoelectric Effect: Planck's Constant Calculation")
```

```
    print("-----")
```

```
    print("Enter experimental data (frequency in Hz, stopping potential in V)")
```

```
    print("Enter 'done' when finished\n")
```

```
    # Collect experimental data
```

```
    frequencies = []
```

```
    stopping_potentials = []
```

```
    while True:
```

```
        user_input = input("Enter frequency (Hz) and stopping potential (V) separated by space: ")
```

```
        if user_input.lower() == 'done':
```

```
            break
```

```
        try:
```

```
            freq, potential = map(float, user_input.split())
```

```
            frequencies.append(freq)
```

```
            stopping_potentials.append(potential)
```

```
        except:
```

```
            print("Invalid input. Please enter two numbers separated by space or 'done' to finish.")
```

```
    if len(frequencies) < 2:
```

```
        print("Error: At least two data points are required.")
```

```

    return

# Convert to numpy arrays
frequencies = np.array(frequencies)
stopping_potentials = np.array(stopping_potentials)

# Perform linear regression
slope, intercept, r_value, p_value, std_err = linregress(frequencies, stopping_potentials)

# Calculate Planck's constant (h = slope * e)
e = 1.602176634e-19 # elementary charge in Coulombs
h = slope * e

# Calculate work function (phi = -intercept * e)
phi = -intercept * e # work function in Joules
phi_ev = -intercept # work function in eV

# Plot the data and regression line
plt.figure(figsize=(10, 6))
plt.scatter(frequencies, stopping_potentials, color='blue', label='Experimental Data')
plt.plot(frequencies, slope*frequencies + intercept, color='red',
         label=f'Linear Fit: y = {slope:.2e}x + {intercept:.2f}\nR² = {r_value**2:.4f}')

plt.xlabel('Frequency (Hz)')
plt.ylabel('Stopping Potential (V)')
plt.title('Photoelectric Effect: Stopping Potential vs. Frequency')
plt.legend()
plt.grid(True)

# Display results
print("\nResults:")
print(f"SLOPE (h/e): {slope:.4e} V/Hz")
print(f"INTERCEPT (-φ/e): {intercept:.4f} V")
print(f"CALCULATED PLANCK'S CONSTANT VALUE (h): {h:.4e} J·s")
print(f"ACCEPTED PLANCK'S CONSTANT VALUE: 6.62607015e-34 J·s")
print(f"PERCENT ERROR: {abs(h - 6.62607015e-34)/6.62607015e-34 * 100:.2f}%")
print(f"WORK FUNCTION (φ): {phi:.4e} J or {phi_ev:.4f} eV")

plt.show()

# Run the function
calculate_plancks_constant()

```