COULOMB'S LAW

Supervised by DR.Ghada Ameereh

ID : Student names

2210003643:Sadeem Alkhamis

2190005914 :Randa Alghamdi

2210003682 : Fatima al-Marar

2200003286:Sumayah almarghoub

2210003677:Shahad Aldossari

جامعة الإمام عبدالرحمن بن فيصل

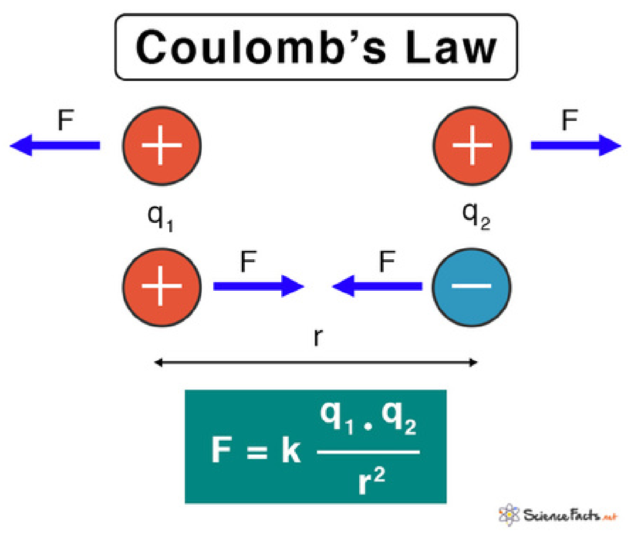
IMAM ABDULRAHMAN BIN FAISAL UNIVERSITY

ABSTRACT

We examine the theoretical and experimental foundations of Coulomb's Law and talk about its many applications not only in electrodynamics but also in quantum physics, cosmology, thermodynamics, and electromagnetic fields. Coulomb's Law is one of the most useful scientific tools known because of its many uses. In practically every branch of physics, its fundamental importance is apparent.

THEORETICAL BACKGROUND

Coulomb's law, or Coulomb's inverse square law, is a power law that imposes the electrostatic factor between electrically charged air and states that:
“The force of attraction or repulsion between two charges in a temporarylocation is the same as the absolute value of how their charges reach, and inversely with the square of the distance apart.”



OBJECTIVE

The primary goal is to write a python code that enables us to calculate Coulomb's law, which expresses the force between two bodies that act as point charges.

DATA&CURVE

	q1	q2	r	r^2	Force
1	3	6	0.03	0.0009	180.000
2	3	6	0.04	0.0016	101.250
3	3	6	0.05	0.0025	64.800
4	3	6	0.06	0.0036	45.000
5	3	6	0.07	0.0049	33.061
6	3	6	0.08	0.0064	25.313
7	3	6	0.09	0.0081	20.000
8	3	6	0.1	0.01	16.200

$$F = ke\frac{|q1|\,|q2|}{r^2}$$

$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0009} = 180.000000\ N$$

$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0016} = 101.250000\ N$$

$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0025} = 64.800000\ N$$

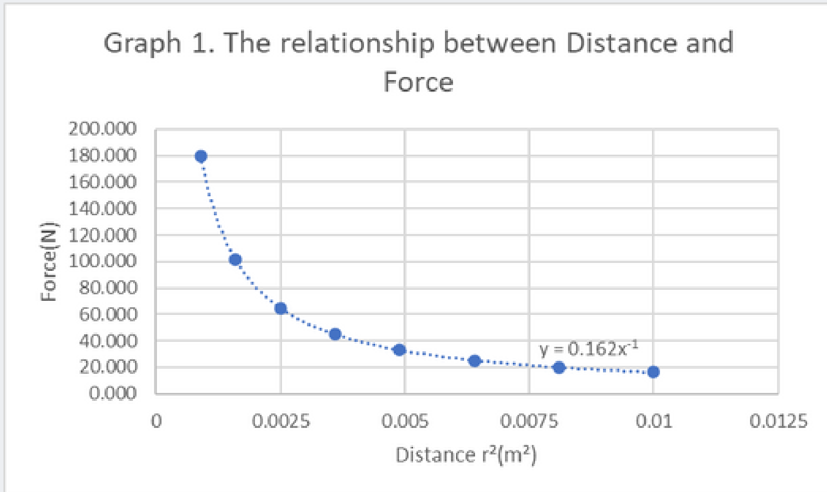
$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0036} = 45.000000\ N$$

$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0049} = 33.061224\ N$$

$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0064} = 25.312500\ N$$

$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0081} = 20.000000\ N$$

$$|F| = 9\times 10^9\,\frac{|3|\,|6|}{0.0100} = 16.200000\ N$$



CODE & OUTPUT

```python
import pandas as pd
data = {
    'Charge one':[3,3,3,3,3,3,3,3],
    'Charge two':[6,6,6,6,6,6,6,6],
    'Distance':[0.03,0.04,0.05,0.06,0.07,0.08,0.09,0.1],
    'Distance_square':[0.03**2,0.04**2,0.05**2,0.06**2,0.07**2,0.08**2,0.09**2,0.1**2]
}

df=pd.DataFrame(data)

df
```

	Charge one	Charge two	Distance	Distance_square
0	3	6	0.03	0.0009
1	3	6	0.04	0.0016
2	3	6	0.05	0.0025
3	3	6	0.06	0.0036
4	3	6	0.07	0.0049
5	3	6	0.08	0.0064
6	3	6	0.09	0.0081
7	3	6	0.10	0.0100

```python
import pandas as pd
def Force(q1, q2, r, k=9 * 10**9):
    F= k * q1 *10**-6* q2*10**-6 / (r**2)
    return F

df['Force'] = Force(df['Charge one'], df['Charge two'], df['Distance_square'])
df=pd.DataFrame(df)
df
```

	Charge one	Charge two	Distance	Distance_square	Force
0	3	6	0.03	0.0009	180.000000
1	3	6	0.04	0.0016	101.250000
2	3	6	0.05	0.0025	64.800000
3	3	6	0.06	0.0036	45.000000
4	3	6	0.07	0.0049	33.061224
5	3	6	0.08	0.0064	25.312500
6	3	6	0.09	0.0081	20.000000
7	3	6	0.10	0.0100	16.200000

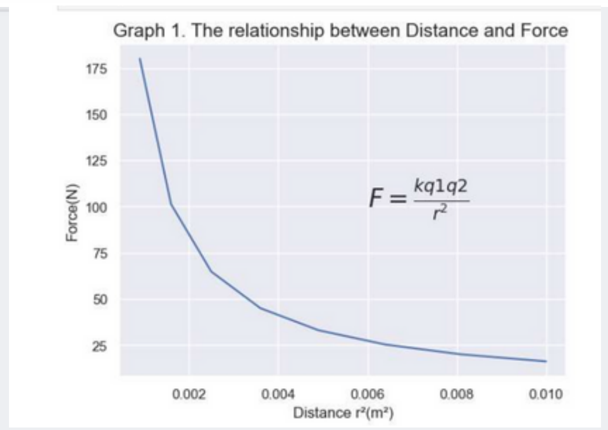
```python
# New Code
import pandas as pd

properties = {"background-color": "lightblue", "color": "white", "text-align": "center
              "border": "2px solid black", "width": "80px"}
styled_df = df.style.format(precision=4).set_properties(**properties)
styled_df
```

	Charge one	Charge two	Distance	Distance_square	Force
0	3	6	0.0300	0.0009	180.0000
1	3	6	0.0400	0.0016	101.2500
2	3	6	0.0500	0.0025	64.8000
3	3	6	0.0600	0.0036	45.0000
4	3	6	0.0700	0.0049	33.0612
5	3	6	0.0800	0.0064	25.3125
6	3	6	0.0900	0.0081	20.0000
7	3	6	0.1000	0.0100	16.2000

```python
#Graph
import matplotlib.pyplot as plt
import seaborn as sns
x=df.Distance_square
y=df.Force
plt.plot(x,y,color="b")
plt.xlabel("Distance r²(m²)")
plt.ylabel("Force(N)")
plt.title("Graph 1. The relationship between Distance and Force ",fontsize=15)
plt.text(0.006,100,'$F=\\frac{k q1 q2}{r^2}$',fontsize=20)
sns.set()
plt.show()
```

```python
import sympy as sym
from sympy import symbols
q1, q2, r, k = symbols('q1 q2 r k')
F = k*q1*q2/r**2
F
```

$$\frac{kq_1q_2}{r^2}$$



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