Coulomb's Law Lab

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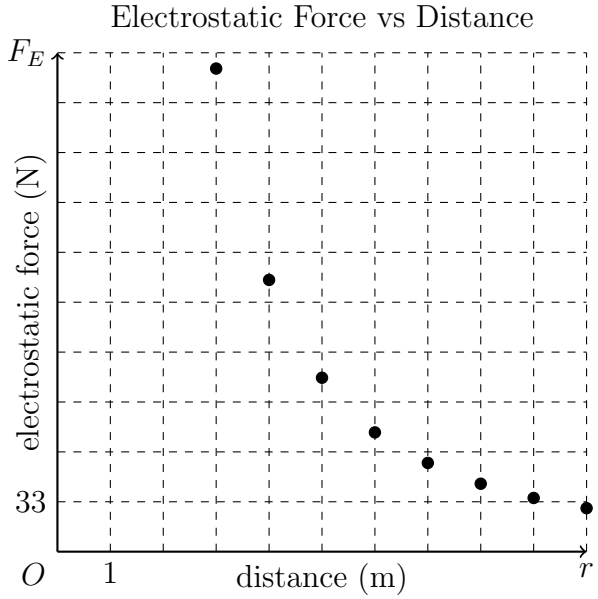
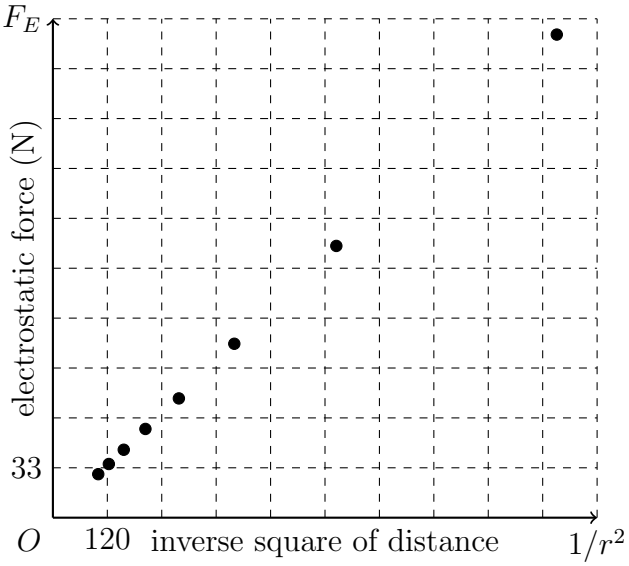
Table 1			
$q_1 = -4\,\mu\text{C}$		$q_2 = 8\,\mu\text{C}$	
$r\,(\text{cm})$	$r^2\,(\text{m}^2)$	$1/r^2\,(\text{m}^{-2})$	$F_E\,(\text{N})$
10	0.01	100	28.76
9	0.0081	≈ 123.457	35.506
8	0.0064	156.25	44.938
7	0.0049	≈ 204.082	58.694
6	0.0036	$277.\overline{7}$	78.889
5	0.0025	400	115.041
4	0.0016	625	179.751
3	0.0009	$1111.\overline{1}$	319.557

Table 2	
$q_1 = 5\,\mu\text{C}$	$r = 6\,\text{cm}$
$q_2(\mu\text{C})$	$F_E(\text{N})$
10	124.827
9	112.344
8	99.862
7	87.379
6	74.896
5	62.414
4	49.931
3	36.448



The graph appears to be decaying exponentially.

Electrostatic force vs Inverse Square of Distance

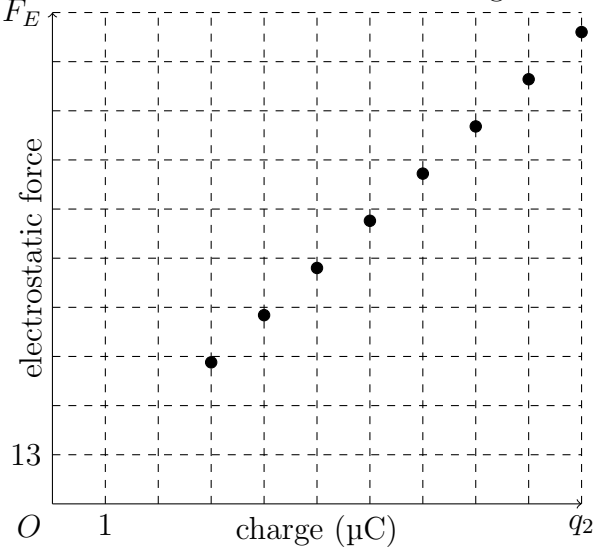


The graph appears to be linear with a positive slope.

$$F_E = k\frac{|q_1||q_2|}{r^2} = \frac{\text{slope}}{r^2} \approx \implies k = \frac{\text{slope}}{|q_1||q_2|} \approx \frac{0.2887}{|-4\times10^{-6}||8\times10^{-6}|} \approx 9.022\times10^9$$

$$\text{error} = \left|\frac{k - k_{\text{known}}}{k_{\text{known}}}\right| \approx 0.377\%$$

Electrostatic Force vs Charge



The graph appears to be linear with a positive slope.

$$F_E = k\frac{|q_1||q_2|}{r^2} = \text{slope}\times10^6\times|q_2| \implies k = \frac{\text{slope}\times10^6\times r^2}{|q_1|} \approx \frac{12.483\times10^6\times0.06^2}{|5\times10^{-6}|} \approx 8.988\times10^9$$

$$\text{error} = \left|\frac{k - k_{\text{known}}}{k_{\text{known}}}\right| \approx 0.003\%$$