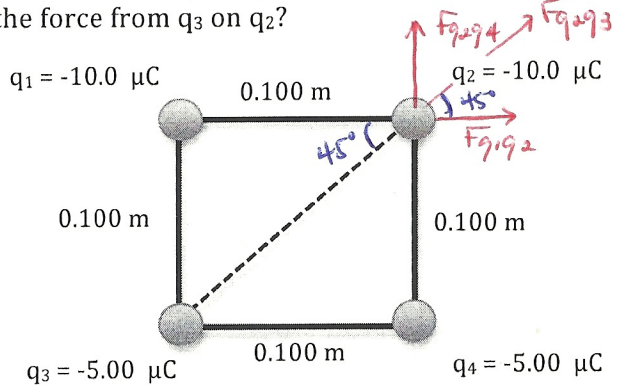
Honors Physics: Electrostatics

Coulomb's Law – Additional Example

Four charges are located at the corners of a square, each with sides measuring 0.100 m in length. The corners are all at right angles with each other. Our goal is to find the net force exerted on q_2.

A. What is the direction and magnitude of the force from q_1 on q_2?
B. What is the direction and magnitude of the force from q_4 on q_2?
C. What is the direction and magnitude of the force from q_3 on q_2?
D. What is the ΣF_x and ΣF_y on q_2?
E. What is the net force felt by q_2?



A.) $F_{q_1q_2} = \dfrac{(8.99\times10^9)\cdot|-10.0\times10^{-6}|\cdot|-10.0\times10^{-6}|}{(0.100)^2}$

$F_{q_1q_2} =$ **89.9 N directly to the right**

B.) $F_{q_2q_4} = \dfrac{(8.99\times10^9)\cdot|-10.0\times10^{-6}|\cdot|-5.00\times10^{-6}|}{(0.100)^2}$

$F_{q_2q_4} =$ **44.95 N directly upwards**

* distance from q_3 to q_2

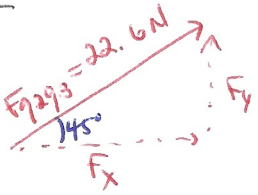
$r^2 = (0.100)^2 + (0.100)^2$

$r^2 = 0.02$

$r = 0.141$ m

C.) $F_{q_3q_2} = \dfrac{(8.99\times10^9)\cdot|-5.00\times10^{-6}|\cdot|-10.0\times10^{-6}|}{(0.141)^2}$

$F_{q_3q_2} =$ **22.6 N → (16.0, 16.0) upwards by 45°**



$F_x = \cos(45°)\cdot 22.6$

F_x = 16.0 N

$F_y = \sin(45°)\cdot 22.6$

F_y = 16.0 N

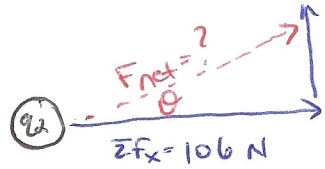
D.) $\Sigma F_x = 89.9 + 16.0$

ΣF_x = 106 N

$\Sigma F_y = 44.95 + 16.0$

ΣF_y = 61.0 N

E.)



$F_{net} = \sqrt{(106)^2 + (61)^2}$

F_{net} = 122 N

$\theta = \tan^{-1}\left(\dfrac{61.0}{106}\right)$

$\theta = 29.9°$