Chapter 15: Electric Forces and Electric Fields

15.1 Properties of Electric Charges

-positive and negative charges
-like charges repel
-electric charge is always conserved
-negative charge is transferred from one object to the other

15.2 Insulators and Conductors

-In Conductors, electric charges move freely in response to an electric force
    -Conductors: Copper, aluminum, and silver
    -Insulators: Glass and rubber
-Charging by Conduction
    -negatively charged rod (excess electrons) comes into contact with an insulated neutral conducting sphere. The excess electrons repel electrons on the sphere creating a local positive charge on the neutral sphere.
-Charging by Induction
    -negatively charged rod (excess electrons) comes close to a neutral sphere causing likes to repel to the other side of the sphere, creating a local positive charge on the neutral sphere

15.3 Coulomb's Law

The magnitude of the electric force F between charges q1 and q2 separated by a distance r is given by:

$$F = k_e \frac{|q_1||q_2|}{r^2}$$

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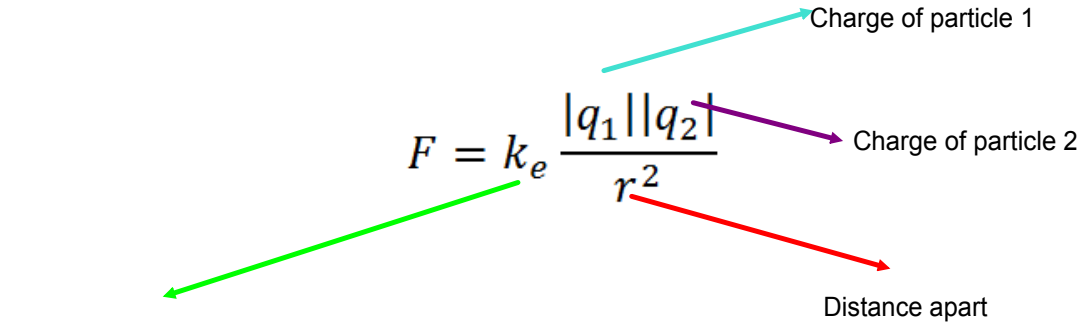
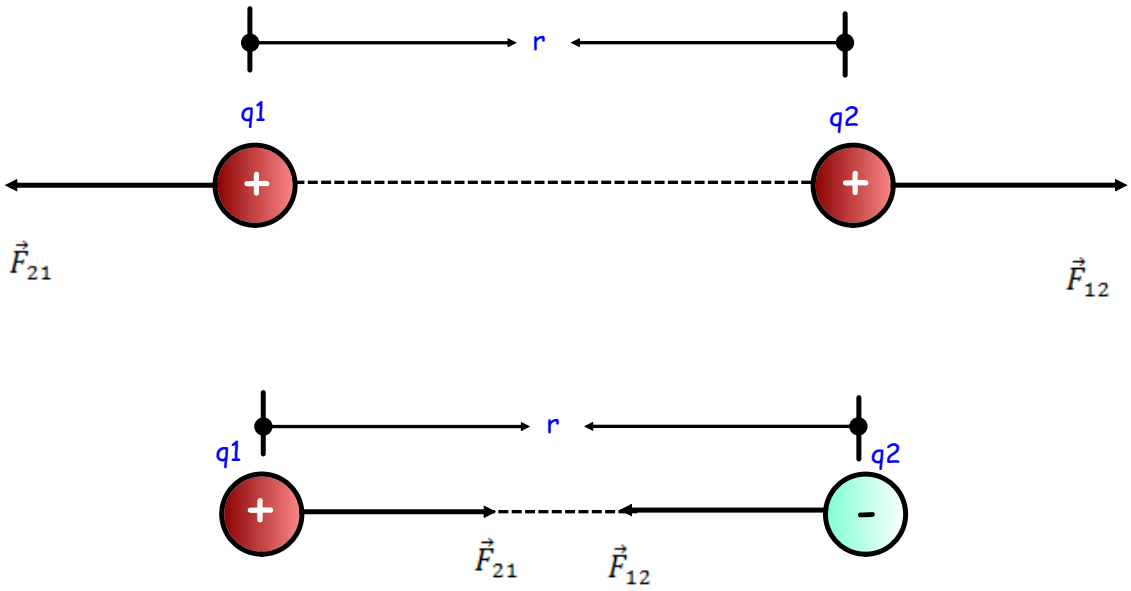


Coulomb Constant

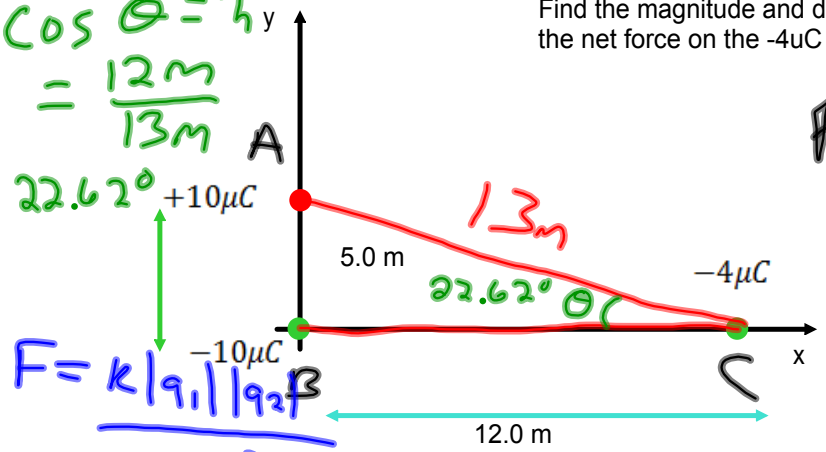
$$k_e = 8.9875 \times 10^9 \frac{N \cdot m^2}{C^2}$$

Charge and Mass of the Electron, Proton, and Neutron

Particle	Charge (C)	Mass (kg)
Electron	-1.60×10^{-19}	9.11×10^{-31}
Proton	$+1.60 \times 10^{-19}$	1.67×10^{-27}
Neutron	0	1.67×10^{-27}


r
q1
q2
+
+
$\vec{F}_{21}$
$\vec{F}_{12}$
r
q1
q2
+
-
$\vec{F}_{21}$
$\vec{F}_{12}$

Higher level thinking Coulombs Law Example



Find the magnitude and direction of the net force on the -4uC charge

$\cos\theta = \frac{a}{h} = \frac{12m}{13m}$

22.62°

$F = \frac{k|q_1||q_2|}{r^2}$

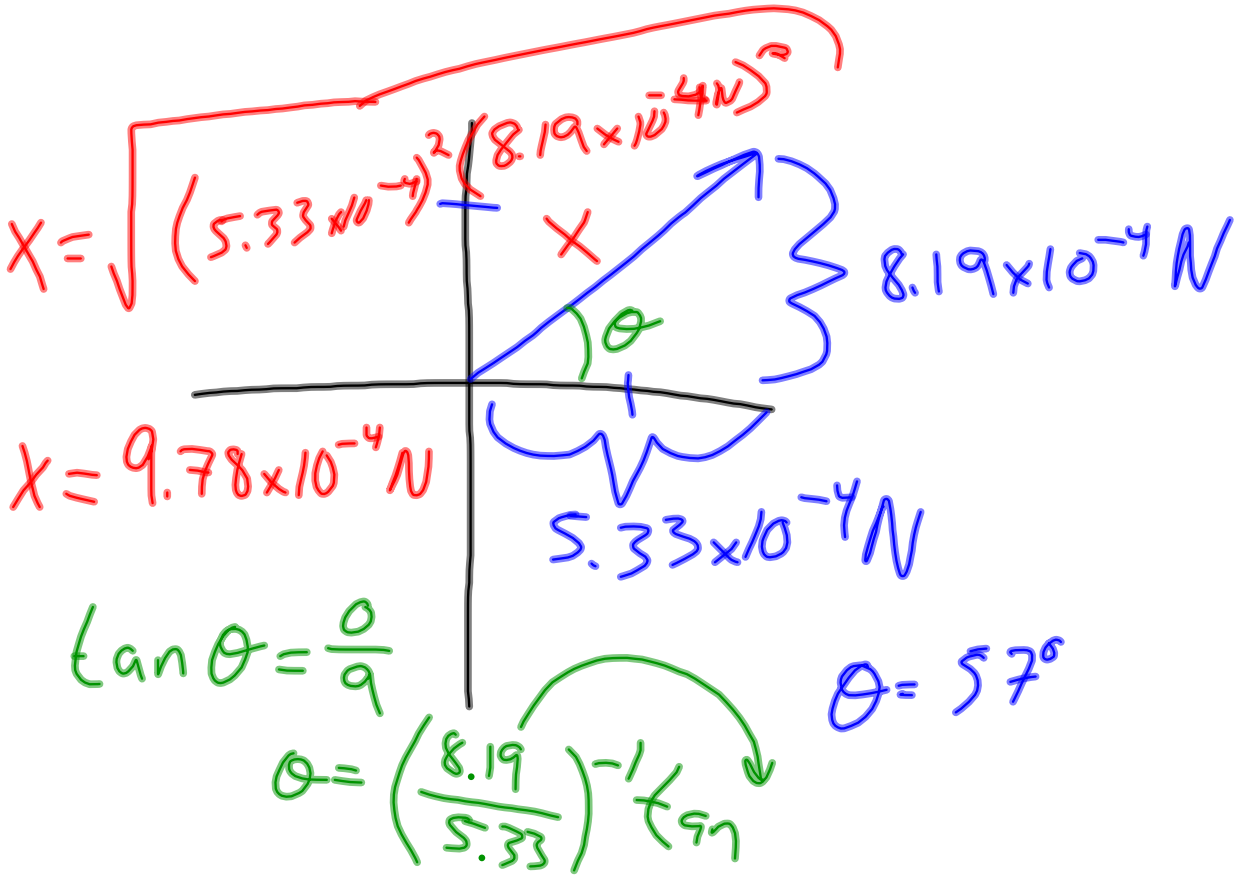
$= \frac{(9.00\times10^9 \frac{N\cdot m^2}{C^2})(10\mu C)(4\mu C)}{(12.0m^2)}$

$F = \frac{k|q_1||q_2|}{r^2} = \frac{(9.00\times10^9 \frac{N\cdot m^2}{C^2})|10\mu C||4\mu C|}{(13m^2)}$

$F = 2.50\times10^{-3}\ N$

Chapter 15 homework

1, 3, 8, 17, 26, 33, 39, 40


$X = \sqrt{(5.33\times10^{-4})^2 + (8.19\times10^{-4}N)^2}$
X
$8.19\times10^{-4}N$
θ
$X = 9.78\times10^{-4}N$
$5.33\times10^{-4}N$
$\tan\theta = \frac{o}{a}$
$\theta = 57^\circ$
$\theta = \left(\frac{8.19}{5.33}\right)^{-1}\tan$