August 23, 2010 — University Physics II

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- Syllabus + Homework Explanations + logistics
- Email : david.milovich@tamiu.edu
- Extra Credit - note takers list

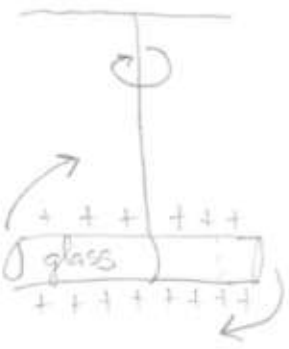
Office Hours: M-R 10-6pm
↳ except! M-R 1:30-2:20pm
MW 3-4:15pm
TR 6-7:15pm

- Chapter 21 : Electrostatics
  ↳ Read Chapter by Wednesday! ***

Positive Charge? Rub glass with a cloth = + charged glass
Negative Charge? Rub plastic with cloth = - charged plastic
(Cannot confirm "+ an "-" → just arbitrary) Benjamin Franklin

→ Confirm: like charges repel, opposites attract

Coulomb Experiment:



$Q_1, Q_2 > 0$ or $Q_1, Q_2 < 0$ = repulsion

$Q_1 < 0 < Q_2$ or $Q_2 < 0 < Q_1$ = attraction

$$\text{Force } (F) = \frac{K Q_1 Q_2}{r^2}$$

K = constant (not Boltzmann's Constant)
Q_1, Q_2 = charges
r = distance btwn. charges

Vector Notation: →

$Q_1 Q_2 > 0 \Rightarrow \frac{K Q_1 Q_2}{r^2} > 0 \Rightarrow$ (Likes repel)

$\vec{F}_{12}$ = force acting on charge Q_1 from charge Q_2

$$\vec{F} = \frac{K Q_1 Q_2 \hat{r}_{21}}{r^2}$$

unit vector pointing from charge Q_2 to charge Q_1

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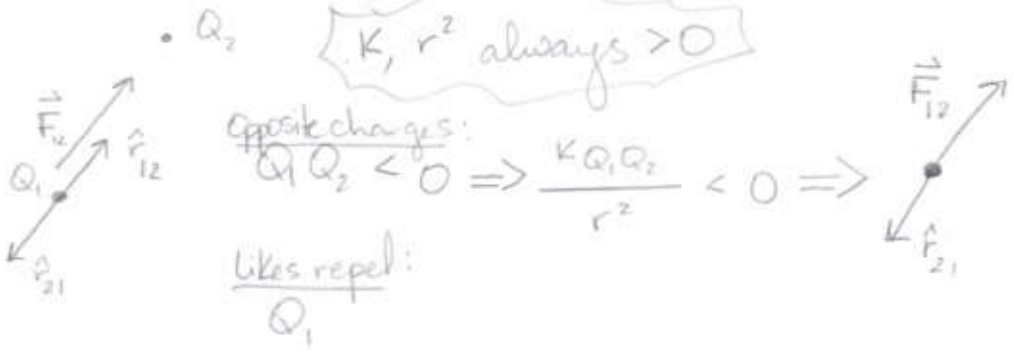
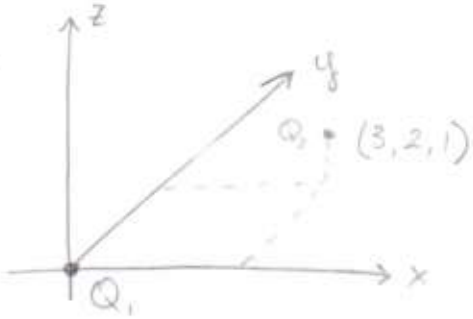
Vector Notation Continued

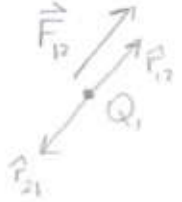


Opposite charges: $Q_1 Q_2 < 0 \Rightarrow \frac{K Q_1 Q_2}{r^2} < 0 \Rightarrow$

Likes repel: Q_1

Ex.





* Unit of charge is Coulomb (C)

* $K = 8.99 \times 10^9 \frac{N \cdot m^2}{C^2}$ (Newtons)

Charge $Q_1 = -2C$ at $\vec{0} = 0\hat{i} + 0\hat{j} + 0\hat{k} = (0,0,0)$

Charge $Q_2 = 3C$ at $(3\hat{i} + 2\hat{j} + \hat{k})$ meters $= (3,2,1)\,m$

r = distance $= \sqrt{(\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2}$

$r^2 = (\Delta x)^2 + (\Delta y)^2 + (\Delta z)^2 = (3m)^2 + (2m)^2 + (1m)^2 = (9+4+1)m^2 = \boxed{14 m^2}$

$\hat{r}_{21} = \frac{\vec{r}_1 - \vec{r}_2}{|\vec{r}_1 - \vec{r}_2|} = \frac{(-3\hat{i}\,m - 2\hat{j}\,m - \hat{k}\,m)}{\sqrt{14}\,m} = \frac{-3}{\sqrt{14}}\hat{i} - \frac{2}{\sqrt{14}}\hat{j} - \frac{1}{\sqrt{14}}\hat{k} = \frac{-1}{\sqrt{14}}(3,2,1)$

$\vec{r}_1 = \vec{0} = 0\hat{i} + 0\hat{j} + 0\hat{k}$

$\vec{r}_2 = 3\hat{i} + 2\hat{j} + \hat{k}$

$\vec{F}_{12} = \frac{(8.99 \times 10^9 N \cdot m^2/C^2)(-2C)(3C)\left(\frac{-1}{\sqrt{14}}(3,2,1)\right)}{14\,m^2}$

on calculator: $\frac{8.99 \times 10^{\wedge}9 * -2 * 3 * -1/\sqrt{14} * 3}{14}$

$= \boxed{3.09 \times 10^9 N\hat{i} + 2.06 \times 10^9 N\hat{j} + 1.03 \times 10^9 N\hat{k}}$