Phys 132 Sp 2026

Lecture 3

Mon: Warm Up 2 D2L

Tues: Discussion / quiz

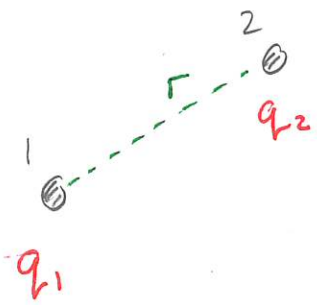
* Before class do Ex 9, 11, 13, 15, 16, 20

* During class discuss in groups

* Quiz at end of class - like one of the questions - formulas provided 5pts

Coulomb's Law

The basic force law that governs situations where one charge is at rest is Coulomb's Law:



The force exerted by particle 1 on 2:

* has magnitude

$$F_{1 on 2} = k\frac{|q_1||q_2|}{r^2} = \frac{1}{4\pi\epsilon_0}\frac{|q_1||q_2|}{r^2}$$

* direction along the line connecting the particles according to repel / attract

Here $k = 8.99 \times 10^{+9}\ N m^2/C^2$

$\epsilon_0 = 8.85 \times 10^{-12}\ C^2/N m^2$

are constants that are the same in all situations.

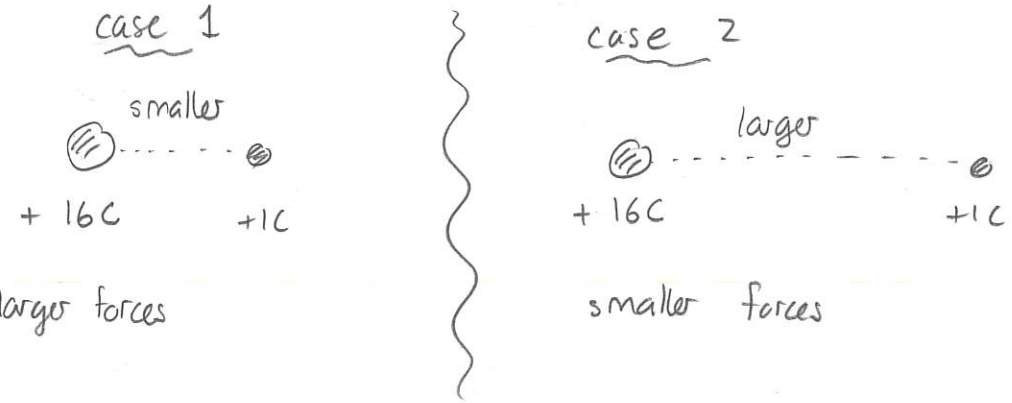
It is important to note that charge and force are different.

Charge is an inherent property of objects. The value of the charge of an object is the same regardless of its surroundings (unless charged is transfered). This is analogous to mass.

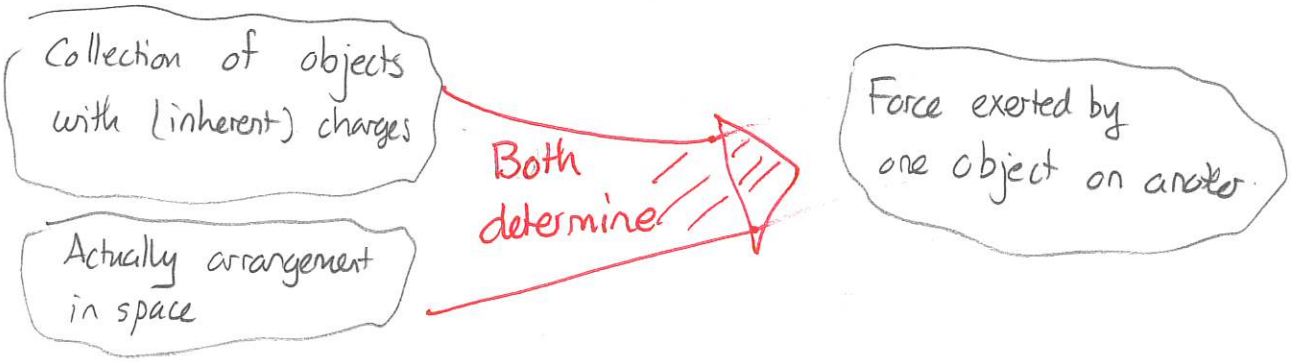
The force exerted depends on the surrounding objects.

Quiz!

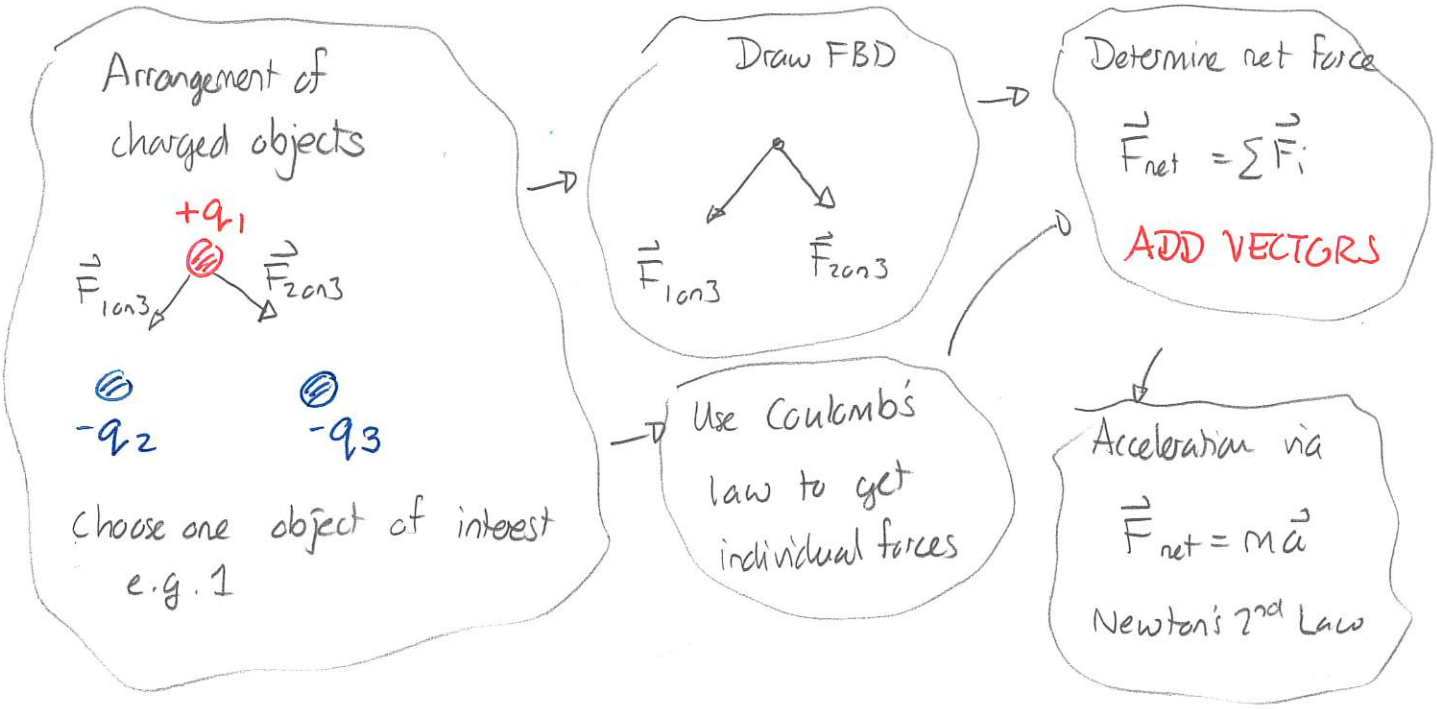
To illustrate this consider



So



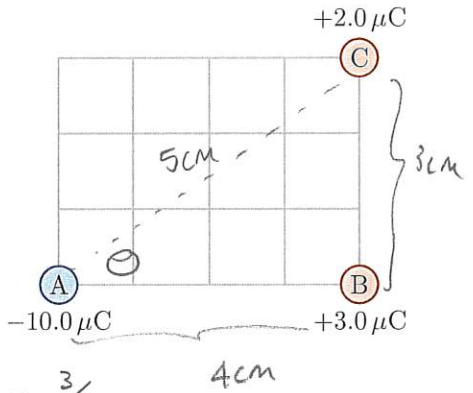
We can now insert this into classical physics



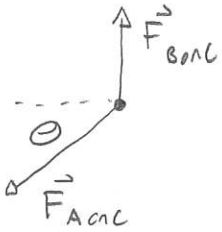
Quiz 2

14 Two dimensional charge arrangements: force, 1

Three charged particles are held fixed as illustrated; the grid units are each 0.010 m. Determine the magnitude and direction of the net force on charge C.

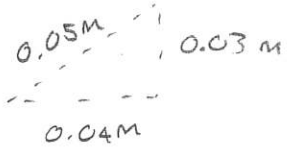


Answer: ① FBD



Get θ via $\tan\theta = \frac{3}{4}$

$\Rightarrow \theta = 36.9°$



② Magnitudes of forces

$$F_{A\text{on}C} = k\frac{|q_A||q_C|}{r_{AC}^2} = 8.99\times10^{+9}\frac{Nm^2}{C^2}\ \frac{2.0\times10^{-6}C \times 10.0\times10^{-6}C}{(0.05m)^2} = 72N$$

$$F_{B\text{on}C} = k\frac{|q_B||q_C|}{r_{BC}^2} = 8.99\times10^{9}\frac{NM^2}{C^2}\ \frac{3.0\times10^{-6}C \times 2.0\times10^{-6}C}{(0.03m)^2} = 60N$$

③ Vector components:

$F_{A\text{on}C\,x} = -72N\cos 36.9° = -58N$

$F_{A\text{on}C\,y} = -72N\sin 36.9°$

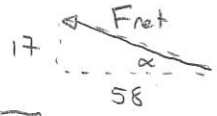
	x	y
$\vec{F}_{A\text{on}C}$	−58 N	−43 N
$\vec{F}_{B\text{on}C}$	0	60 N

④ $F_{net\,x} = -58N + 0N = -58N$

$F_{net\,y} = -43N + 60N = 17N$

$\vec{F}_{net} = -58N\,\hat{i} + 17N\,\hat{j}$

magnitude



$F_{net} = \sqrt{(58N)^2 + (17N)^2}$

$F_{net} = 60N$

$\tan\alpha = \frac{17}{58} \Rightarrow \alpha = 16°$

Quiz 3.