PY 202

21: 1–4

reading: 21
4–6

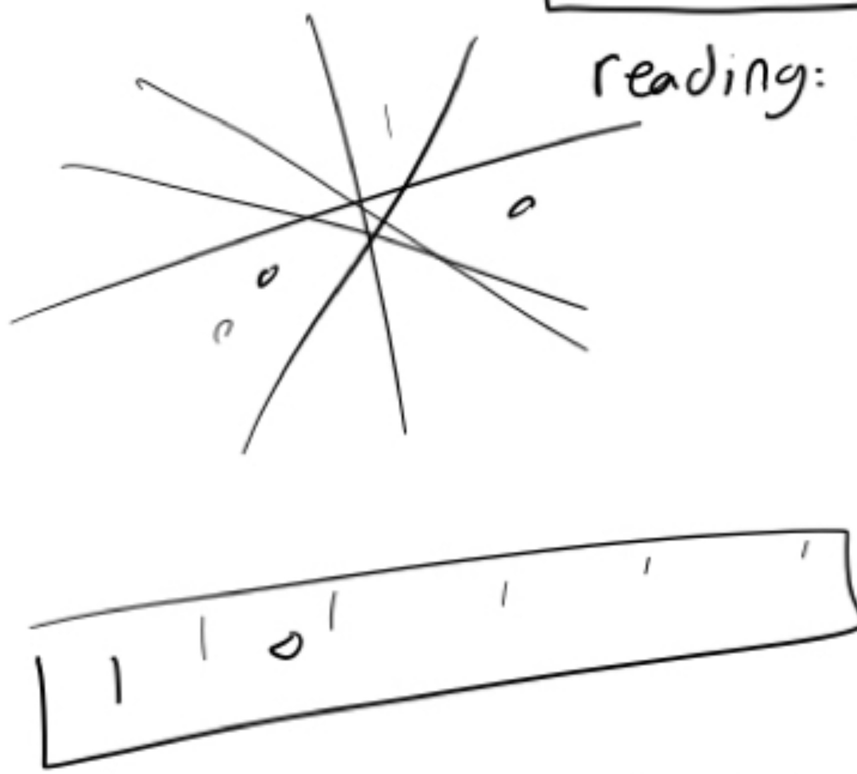


Fig. 1: My LSH illusttation

office: next to Dr. Reynolds

while they're going over HW rubric:

- I need to reply to Dr. Townsend
- I need to return my stat book
- I need to visit an NCSU seismologist
- I need to visit the NCSU body visualization lab
- Purchase Web Assigns!

I get a clicker!

Go to Moodle, Turning Tech, and
REGISTER YOUR CLICKER

NCSA competition

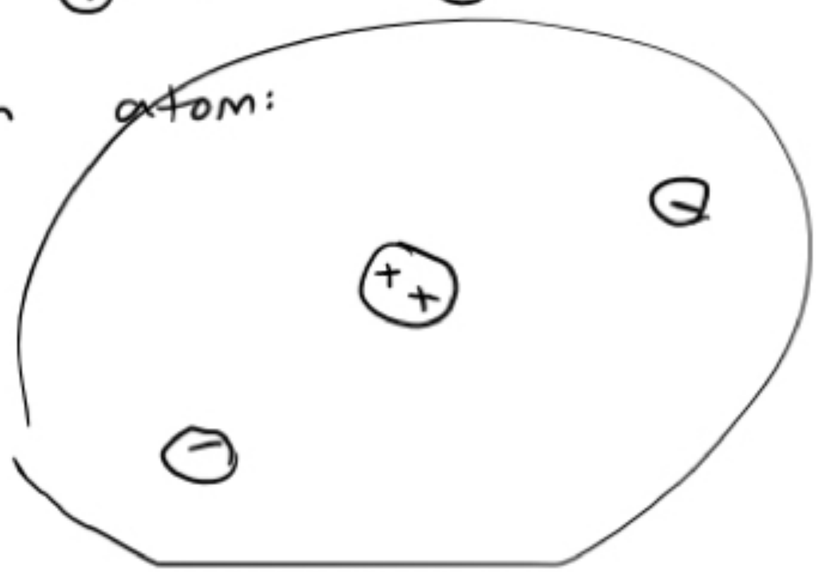
Write out all HW on paper; submit ans for WA's to WA.

Charges and Coulomb's Law
(and the Force between charges)

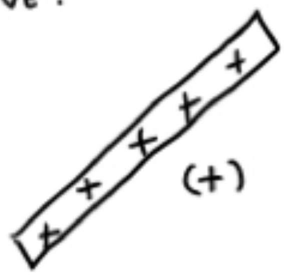
Two types of charges:

positive +   negative −

in an atom:



- Probably easier to move e^- than nucleus, right?
- charging always moves electrons - your mobile charges! And only they can move.

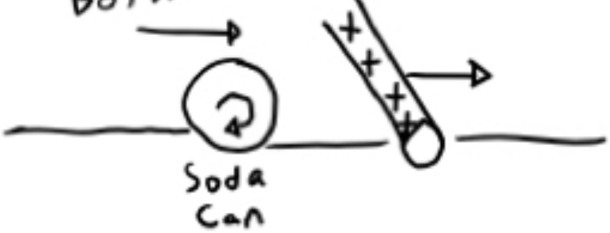


(+) charge: must have removed electrons $\Rightarrow$ net positive charge

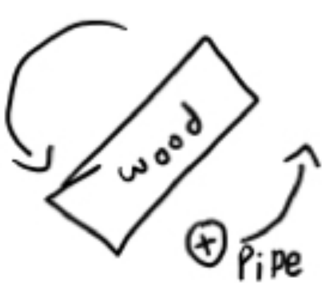
Insulators and Conductors: diff levels of electron mobility

Conductor: electrons can move.
Insulator: electrons are not free to move.

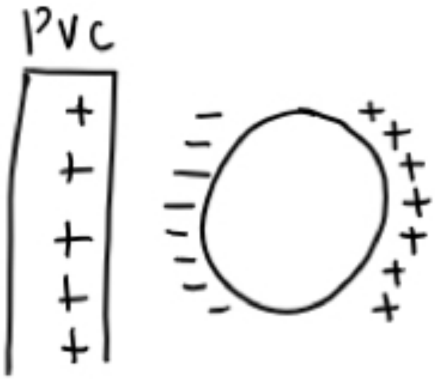
You can get attractive/repulsive force with both



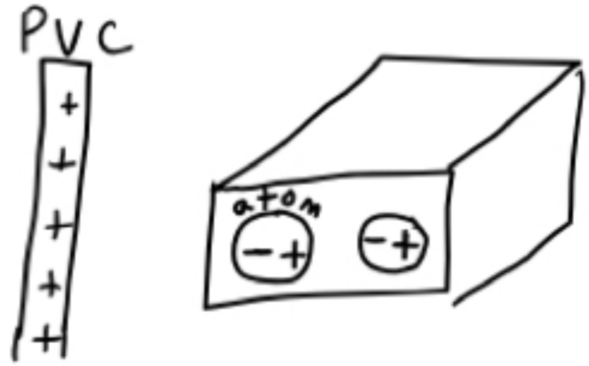
electrons in can are attracted to rod. (can is conductor)



electron mobility within the atoms on the wood's edge (not throughout the wood) move to the pipe's positive charge.



can



wood

How do you charge something?

- charge by friction

(Earth: infinite reservoir of charge)
(Ground: exchange q w/ earth, but basically just changing obj's net charge without much changing the earth's net charge.)

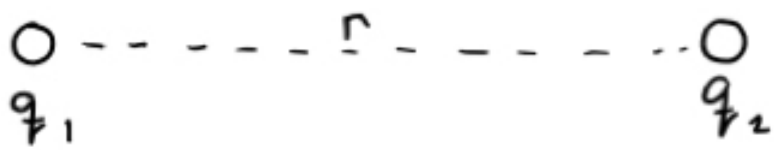
pulling q from earth

- Charge by induction (without touching)

- charge by conduction

Coulomb's Law

$$F_{1,2} = \frac{K\,|q_1 q_2|}{r^2}$$



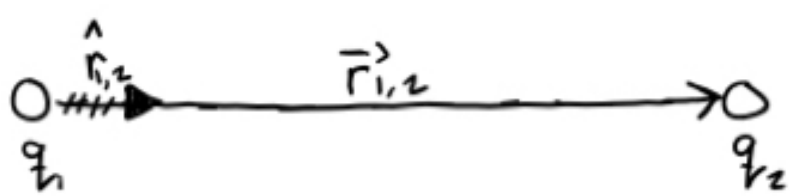
Units of charge: 1 Coulomb (1 C)

distance: meters

$$K = 8.99E9 \ \mathrm{Nm^2/C^2}$$

$$= \frac{1}{4\pi\epsilon_0}$$

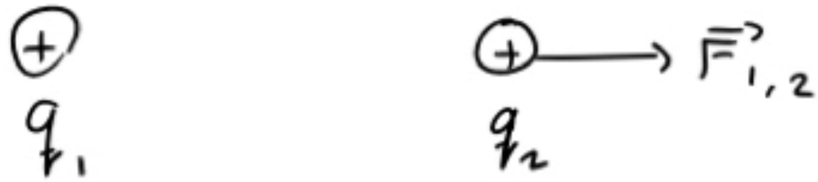
$$\vec{F}_{1,2} = K \frac{q_1 q_2}{r_{1,2}^2} \hat{r}_{1,2}$$



Force exerted by q_1 on q_2

ex] $q_1 = q_2 = 5\ \mu C$

$\vec{r}_{1,2}$ points from 1 to 2,



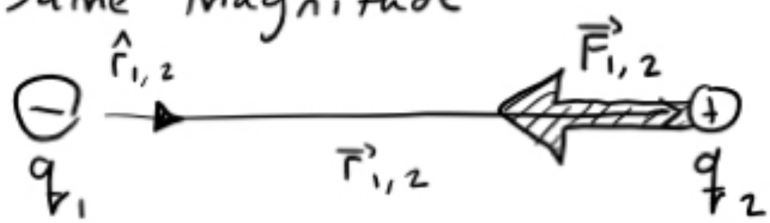
Force is also (+). Also,

$$\vec{F}_{2,1} = -\vec{F}_{1,2}$$

refers to direction

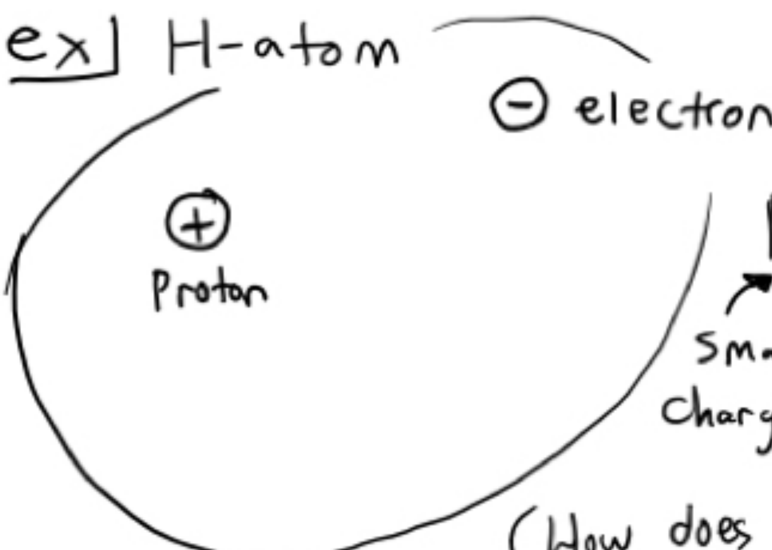
Same magnitude

ex]



$$\vec{F}_{1,2} = - \ldots \hat{r}_{1,2}$$

ex] H-atom



$|q_e| = 1.6E{-19}\ C$

Smallest unit of charge you can have.

(How does an electron carry charge

$|q_p| = 1.6\text{E}{-19}\ C \quad (= |q_e|)$

$r \approx 5.3\ \text{E}{-11}\ m$

$F_{el} = 8.2e{-8}\ N$ (strong!)

Compare to gravitational force between them:

$$F_g = \frac{G\, m_p M_e}{r^2}, \quad m_p = 1.67e{-27}\ kg, \quad M_e = 9.11e{-31}\ kg$$

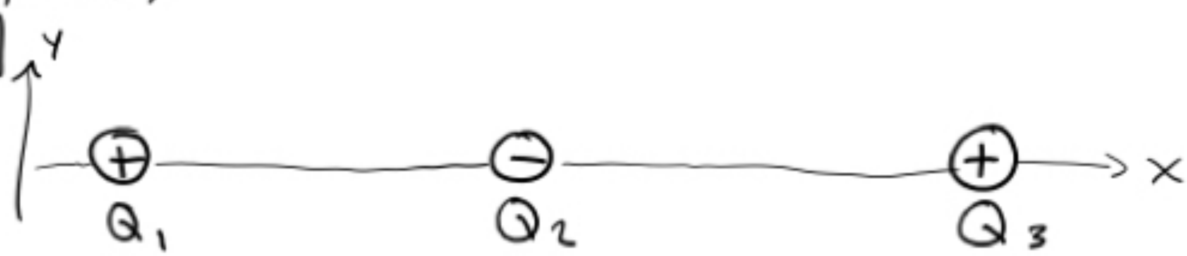
$$F_{el} = ma$$

$$F_{el} \,/\, F_{grav} = 2.27 \times 10^{39}$$

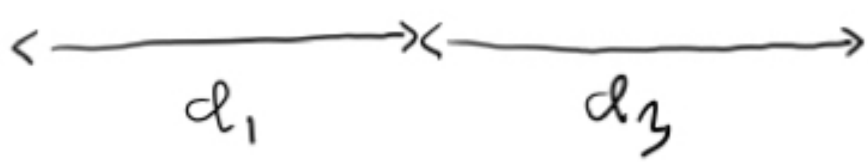
for H-atom

(this is why, in many cases, we may ignore gravity when working with electric forces)

ex)



Force on Q_2?



$$\vec{F}_{net\ on\ 2} = \vec{F}_{1,2} + \vec{F}_{3,2} \quad \left(\begin{array}{l}\text{vector} \\ \text{addtn!}\end{array}\right)$$