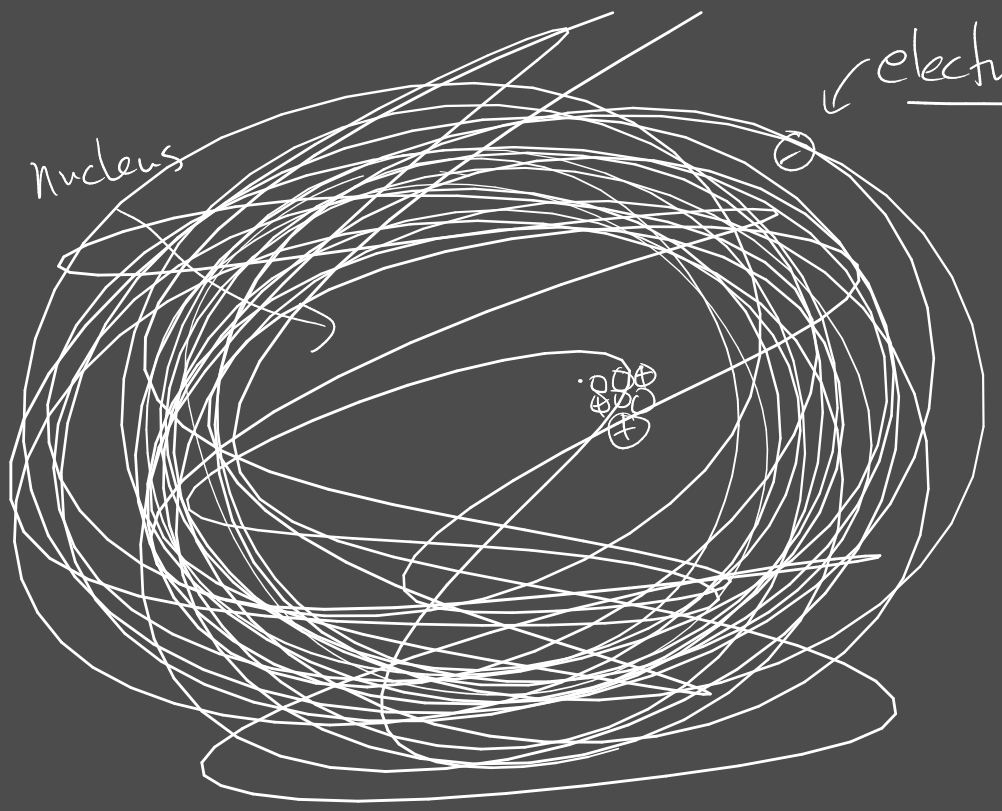
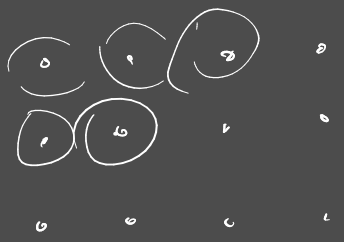
Chapter 12

Atom

- nucleus
  - protons - positive
  - electrons - negative
  - neutrons - no charge



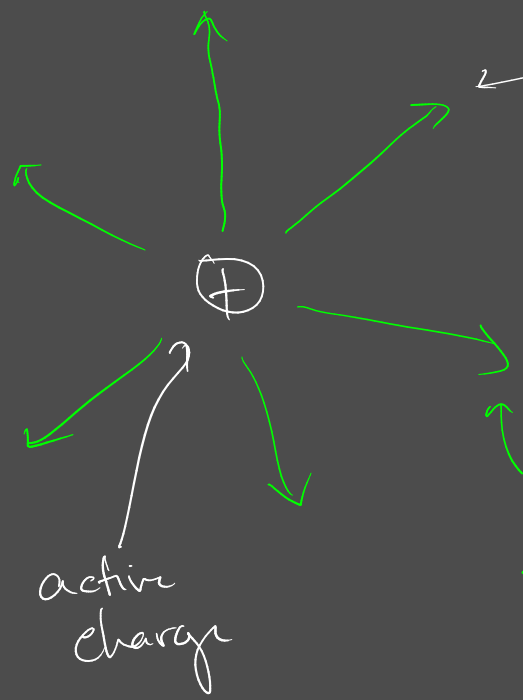


Electric Field → force field that results from charge

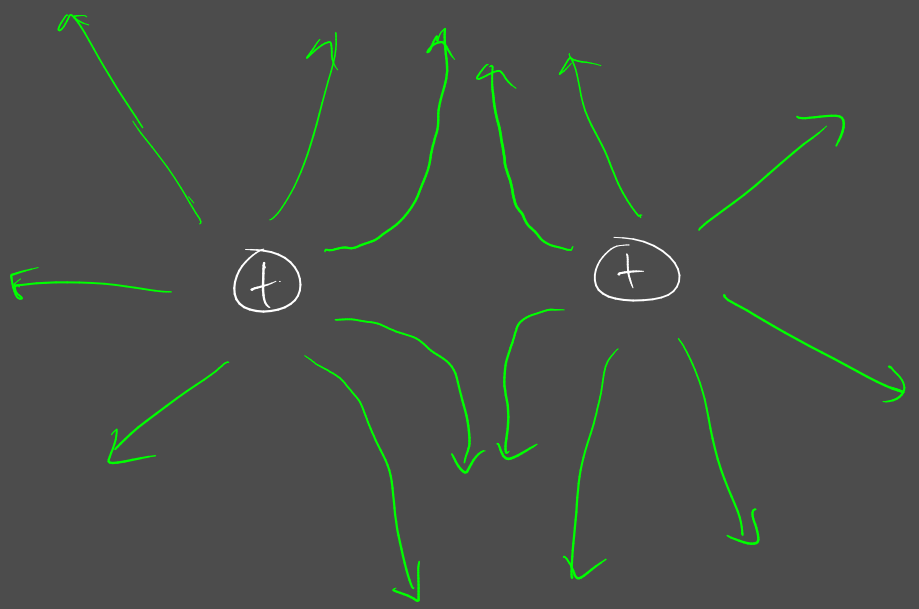
Electric Force = charge in a field × Field caused by another charge

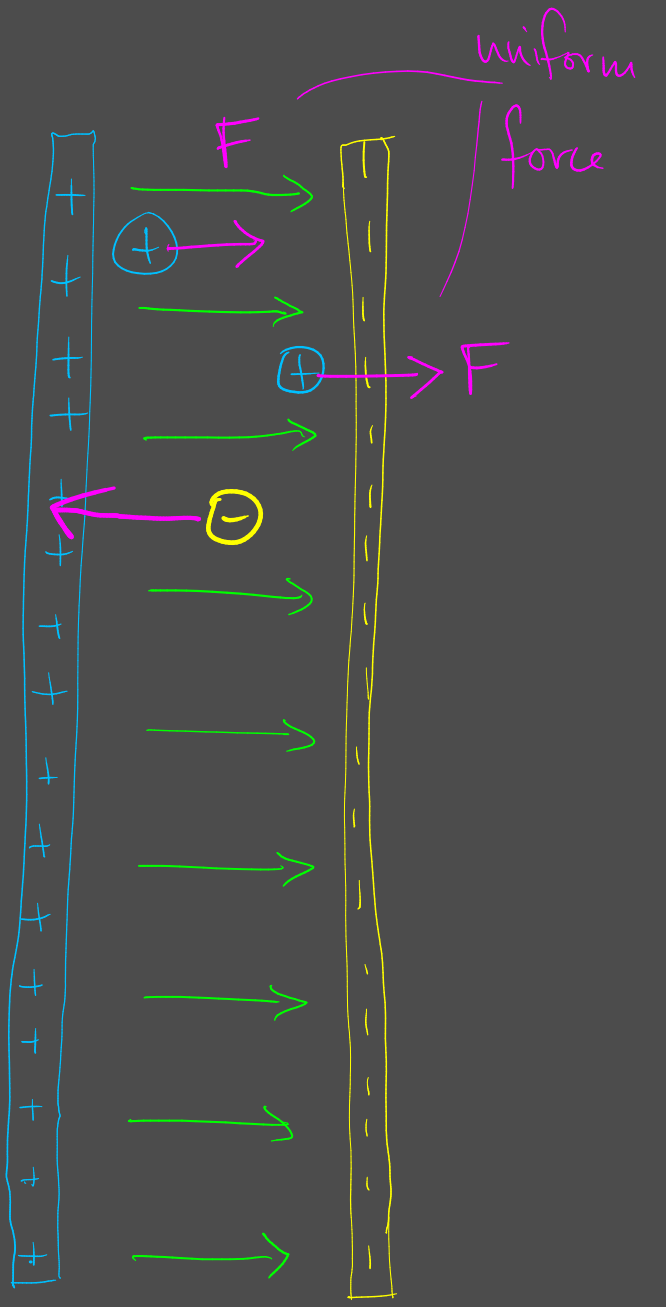
"passive" charge being acted on by the field.

"active" charge ↓ producing an electric field



← direction of field lines is direction of force on a positive passive test charge.





charge → 1 unit of charge

→ 1 Coulomb

1 elementary charge → charge of one electron or proton

fundamental

6.24×10^{18} electrons = 1 Coulomb

What is the charge of 1 electron in terms of Coulomb?

$$1 \text{ elementary charge} = \frac{1\,C}{6.24 \cdot 10^{18}\,e} = 1.6 \times 10^{-19}\,C/e$$

always true | Electric Field can be complicated

$$\text{Force} = \text{passive charge} \times \text{Field}$$

q_2

$q_1 = 10C$ $\quad$ $q_2 = 2C$

(+) ..... (+)

10 m

Coulomb's Law

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

only true for two point charges

$$k = 9 \cdot 10^9 \frac{N m^2}{C^2}$$

↳ Coulomb constant

Electric Field

point charge

$$E = \frac{k q_1}{r^2}$$

$2\,\mu C = 2 \cdot 10^{-6}\,C$

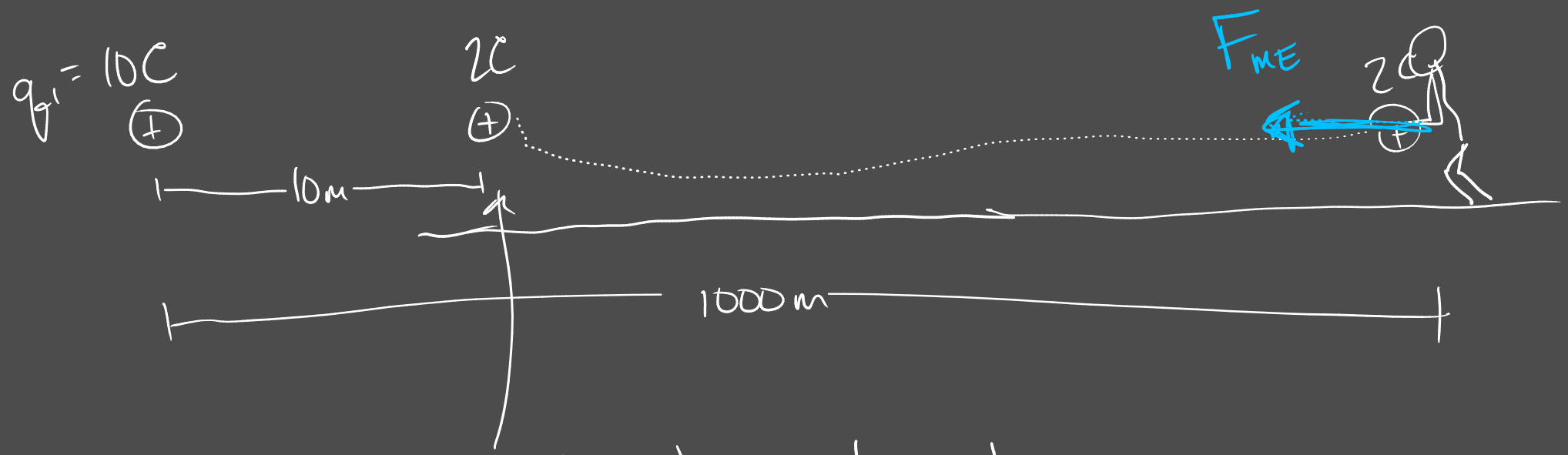
$0.6\,\mu C = 0.6 \cdot 10^{-6}\,C$

$10\,mC = 10 \cdot 10^{-3}\,C$

Electric field

$E \left[\frac{N}{C}\right]$ $\quad F = q \cdot E$

$[N] = [C] \cdot \left[\frac{N}{C}\right]$



Work has been done to get the charge to here.

The charge now has potential energy

$$\frac{\text{Potential Energy}}{\text{unit of charge}} = \text{Voltage}$$ (Electric Potential)