① Gravitational force $F = G\frac{m_1 m_2}{r^2}$ $G \rightarrow$ constant

② Electromagnetic force :- → Electro + Magnetic force

q_1 —— r —— q_2 $\Rightarrow$ $\boxed{F = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}}$ $\rightarrow K$

(i) Sign of Charge $+q_1, +q_2 \Rightarrow \vec{F}$ = replusive

(ii) Sign of Charge $+q_1, -q_2 \Rightarrow \vec{F}$ = Attaractic

Same sign = Repulsion & Oppsite sign = attraction

$$\boxed{F_{Coulumb} = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2}}$$

$\frac{1}{4\pi\varepsilon_0} \rightarrow$

Bio-Savart law

$\frac{\mu_0}{4\pi}$

N1 $Q_A = +8\mu C$ $Q_B = -5\mu C$ $r = 10\,Cm$

Q_A ←— 10 Cm —→ Q_B

$F_{Coulumb} =$

$Q_A = +8\mu C = 8\times10^{-6}\,C$

$Q_B = -5\mu C = -5\times10^{-6}\,C$

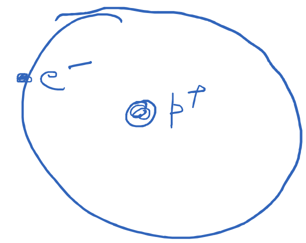
$r = 10\,Cm = 0.1\,m$

$F = K\frac{Q_A Q_B}{r^2} = 9\times10^{9}\,\frac{8\times10^{-6}\times5\times10^{-6}}{(0.1)^2}$

$\boxed{F = 36\,N}$

Comparison of Coulumb Gravitation force

H_2 atom = $r = 5.3 \times 10^{-11}$ m



$F_{Columb} = 8.2 \times 10^{-8}$ N $F_G = 3.6 \times 10^{-47}$ N

$$\frac{F_{Columb}}{3.6 \times 10^{-47}} \approx 10^{39}$$

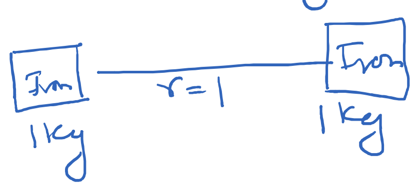
$\Rightarrow$ $\boxed{\text{Columb force is } 10^{39} \cdot F_G}$

N2

Suppose the charge netrality does not hold in a world, and the e^- has 1% less magnitude than proton. What is the Columb force acting between two iron blocks of mass 1 kg seprated by 1 m.

No. of proton in an iron atom ≈ 26
56 kg of iron Contains 6×10^{26} kg atoms

$\Rightarrow$



Will there be Columb force?

26 e^-
26 p^+

(i) magnitude of charge is same
(ii) No. of e^- = No. of p^+

$n = -1.67 \times 10^{-19}$ C
$p^+ = +1.67 \times 10^{-19}$ C

ii

$e^- = -1.50 \times 10^{-19}$ C
$p^+ = +1.67 \times 10^{-19}$ C

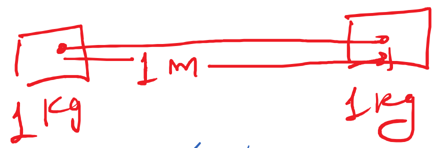
$\boxed{26\ e^-,\ 26\ p^+}$

Will there be a net Zero charge = NO

Assume a Situation — e^- has 1% less magnitude than proton

$26\,p^-$ in an Fe atom

52 kg iron $= 6\times10^{26}$ atoms



$\frac{1}{100} = 0.01$

atoms in 1 kg iron $= \left(\frac{6\times10^{26}\text{ atoms}}{56\text{ kg}}\right)$

(ii) In one atom, we have 26 protons

$\boxed{26\times 0.01\times 1.6\times10^{-19}\,C}$

$$\text{Total } q = \underbrace{\left(\frac{6\times10^{26}}{56}\right)}_{N\text{ atom}} \times \underbrace{\boxed{26\times0.01\times10^{-19}}}_{q\text{ of one atom}}$$

$\boxed{q = 4.3\times10^{5}\,C}$

$Q_A = 4.3\times10^{5}\,C \qquad Q_B = 4.3\times10^{5}\,C \qquad r = 1$ meter

$\boxed{F = k\frac{Q_AQ_B}{r^2}} \Rightarrow \boxed{1.7\times10^{21}\,N}$

$\boxed{F = 1.7\times10^{21}\,N}$

Nuclear force: — Short-range force, very powerful, works on charged as well as neutral particles.

Nucleons → protons + Neutrons, e^- can orbit in the outer region

But most of the mass is concentrated in the nucleus.

$+p^+, n$

$\sim 10^{-15}$ meter $\approx$ Femtometer

⇒ Do you think that nuclear forces are always attractive

$\boxed{\text{Study the varition of nuclear force with distance}}$

Weak force:

β^- decay

$n \rightarrow p +$ antineutrino

β^+ decay

$p \Rightarrow n +$ neutrino

Weak force:

β^- decay

$n \rightarrow p +$ antineutrino

β^+ decay

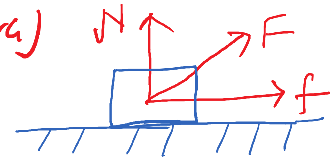
$p \rightarrow n +$ neutrino

Friction :-

Monday, February 15, 2021 7:16 PM

$\perp$ Component $=$ N (Normal force)

$=$ Component $=$ f (friction)



N.1 $m = 400$ gram , $f = 3.0\ N$

(a) angle made by the contact force on the body with vertical

$f = 3.0\ N$ $\quad N = mg = (0.400) \times 10 = \underline{4\ N}$

$$\boxed{\tan\theta = \frac{f}{N}} = \quad \Rightarrow \theta = \tan^{-1}(3/4) \simeq \underline{37^\circ}$$

(2) $$F = \sqrt{N^2 + f^2} = \sqrt{3^2 + 4^2} = 5.0\ N$$