unacademy

Comprehensive Course on Electronic Devices

Semiconductor Physics - Part I

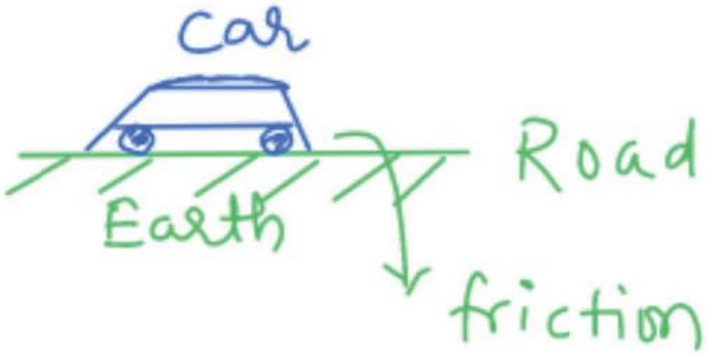
Lesson 1 • July 25, 2020 • Kamesh Shrivastava

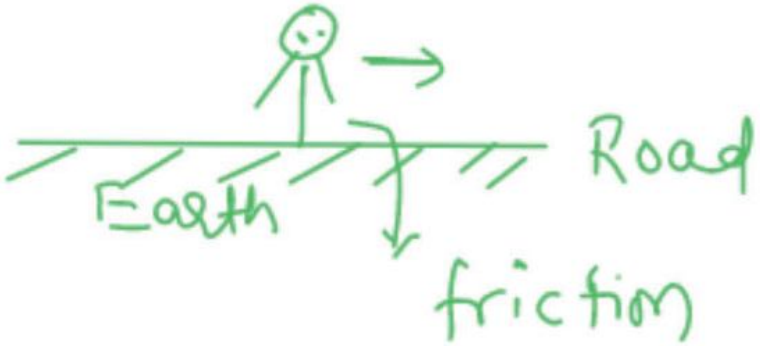
"Syllabus"

1. Semiconductor physics
2. PN junction diode & special diodes.
3. MOS capacitor
4. MOSFET
5. BJT
6. IC Fabrication
7. CMOS Inverter

Books:

1. Streetman & Banarjee
2. Donald A Neaman
3. S.M Sze
4. Taur & Ning
5. Yannis Tsividis
6. Mark Lundstrom (Nanoscale)





↳ gravity is responsible for contact of two bodies & then friction is important for motion of object. (car).

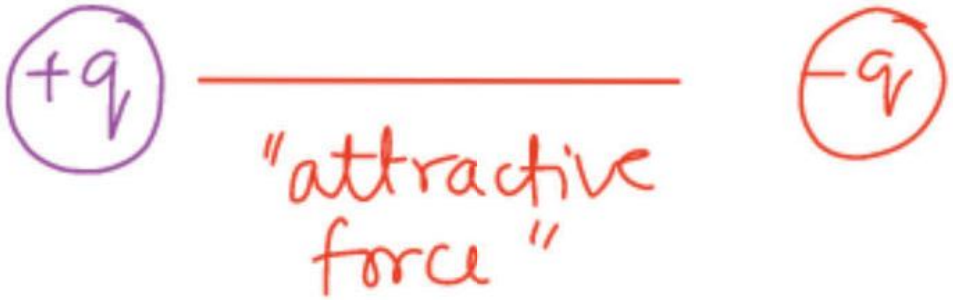
→ Who is responsible for gravity?

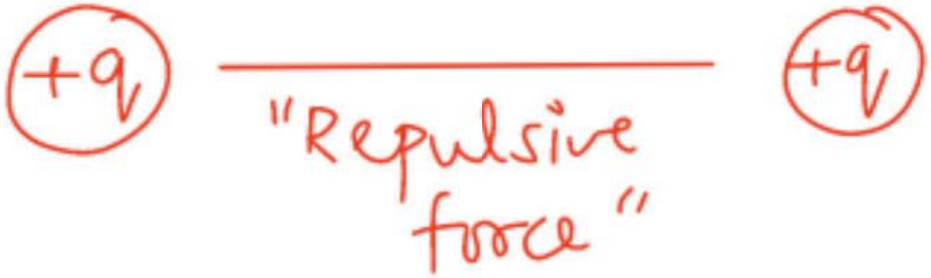
→ Mass

Mass :- Mass is the fundamental property of an object, which is responsible for gravitational force of attraction.

Charge: Charge is the fundamental property of a particle, which is responsible for electric force.

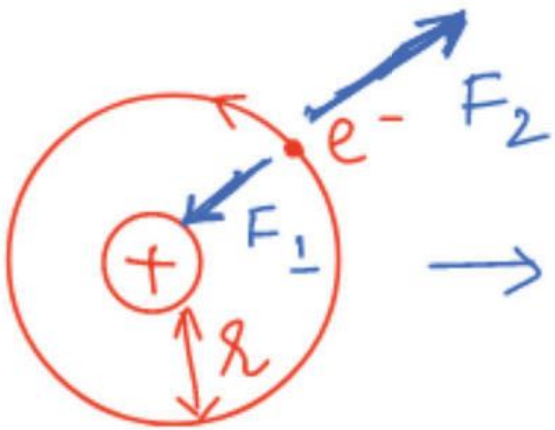
This force may be attractive (or) repulsive depending on nature of other charge present.





<u>Electronics</u> :- is the study of motion of charge inside a semiconductor.

Why e^- does not fall in the Nucleus?



$\Sigma F = 0$ (in radial direction)

$F_2 + F_1 = 0$

$\rightarrow$ Centrifugal force + Centripetal force $= 0$ — (1)

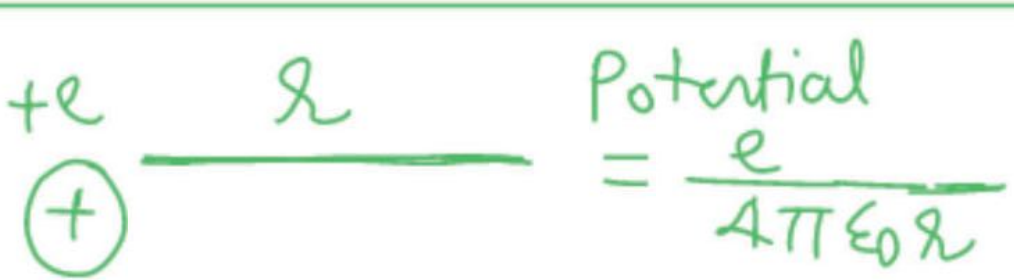
$$\frac{mv^2}{r} + \frac{e \times (-e)}{4\pi\varepsilon_0 r^2} = 0$$

$$\frac{mv^2}{r} = \frac{e^2}{4\pi\varepsilon_0 r^2} \quad \text{— (2)}$$

$$mv^2 = e^2/4\pi\varepsilon_0 r$$

Total Energy of e^- (E_T) = K.E + P.E.

$$E_T = \frac{1}{2}mv^2 + \frac{-e^2}{4\pi\varepsilon_0 r}$$



Potential $= \dfrac{e}{4\pi\varepsilon_0 r}$

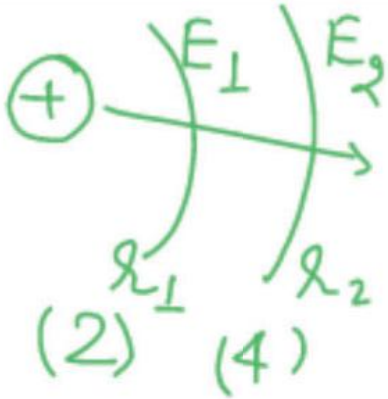
P.E. of e^- = potential × charge $= \left(\dfrac{e}{4\pi\varepsilon_0 r}\right)(-e)$

P.E. of e^- $= \dfrac{-e^2}{4\pi\varepsilon_0 r}$

$$E_T = \frac{1}{2}\left(\frac{e^2}{4\pi\varepsilon_0 r}\right) - \left(\frac{e^2}{4\pi\varepsilon_0 r}\right) = \frac{-e^2}{8\pi\varepsilon_0 r}$$

$$\boxed{E_T = \frac{-e^2}{8\pi\varepsilon_0 r}}$$ "Joules" (3)

If we move away from the nucleus Total Energy & P.E of e^- increases.



Ex:

$$E_T = \frac{-c}{r} = \frac{-20}{r}$$

$$E_1 = \frac{-20}{2} = -10$$

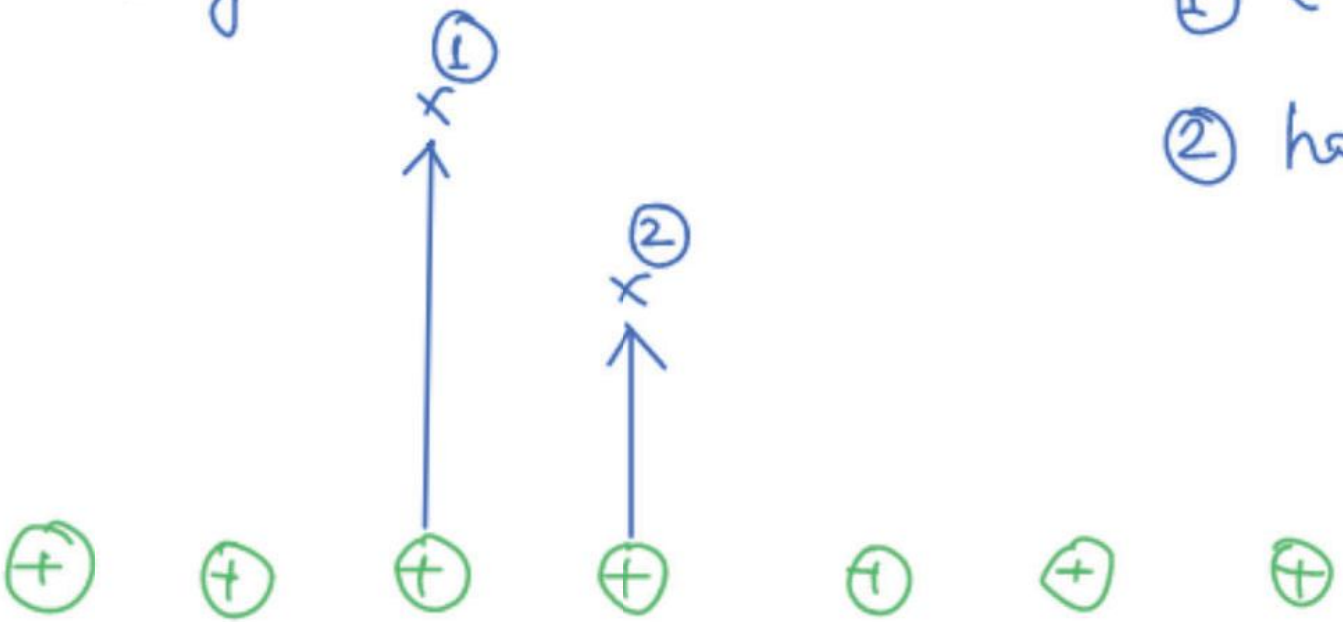
$$E_2 = \frac{-20}{4} = -5$$

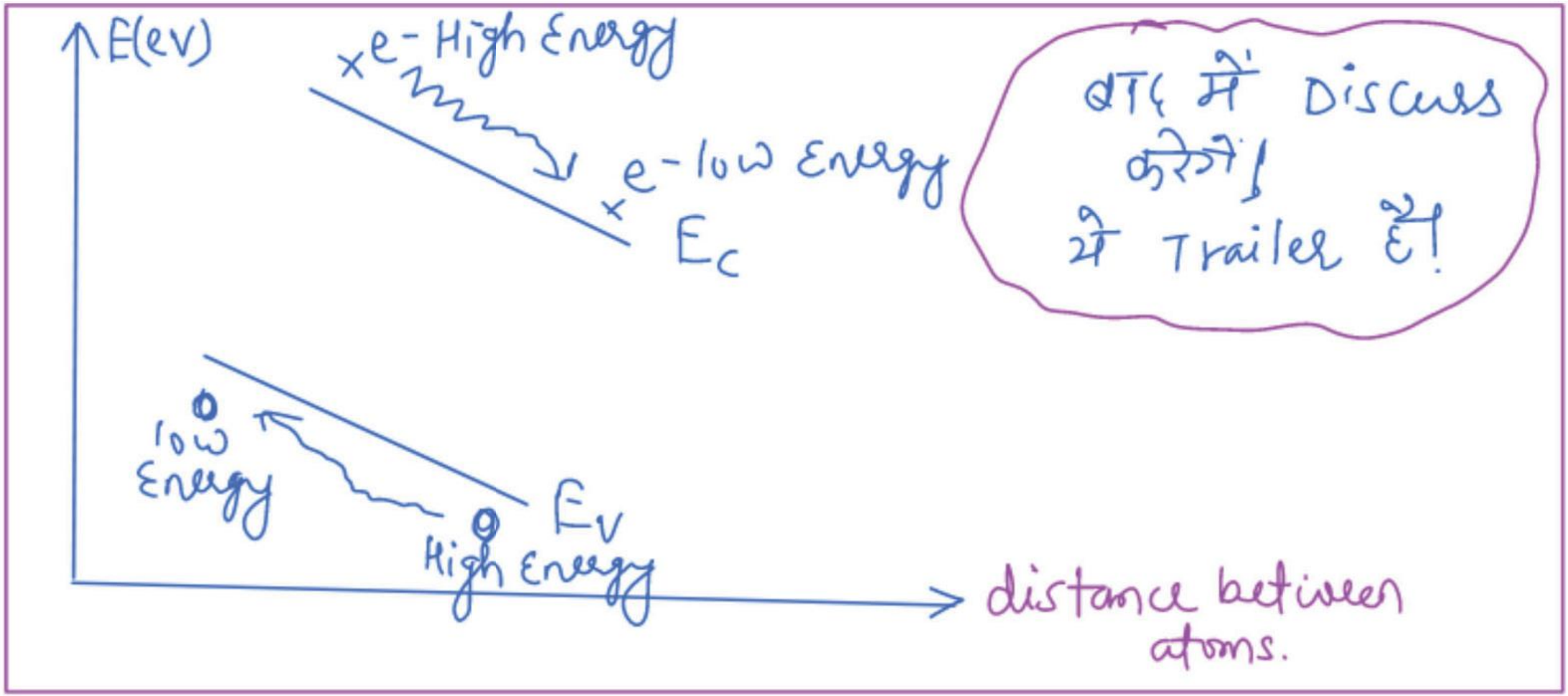
$E_2 > E_1$ $\quad r_2 > r_1 \Rightarrow E_T \propto r$

The Total Energy of e^- and P.E. of electron increases in upward direction. Whereas total Energy of holes & P.E. of holes increases in downward direction. BCZ we have assumed Nucleus at the bottom of the page.

① e^- Energy > ② e^- Energy

② holes Energy > ① holes Energy




E(eV)
e- High Energy
e- low Energy
E_c
low Energy
High Energy
E_v
distance between atoms.
DTC में Discuss करेंगे!
ये Trailer है!