Preparation of Nano material :—

Tuesday, April 6, 2021 1:23 PM

(i) Top to down approch

(ii) Bottom to Up approch

Recall

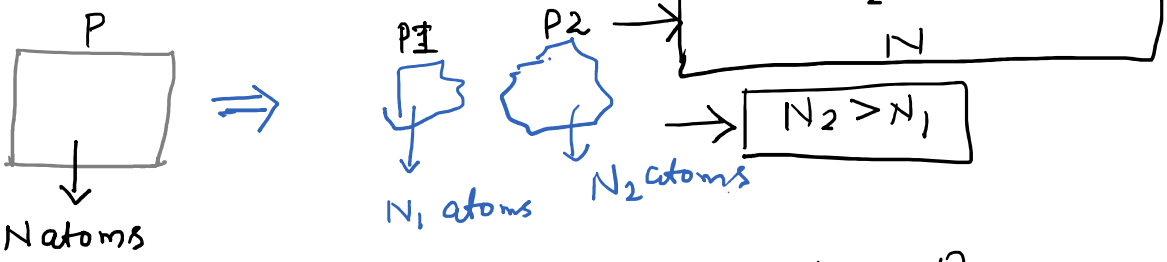
Classification was based on number of atoms.

Atom — Molecule — Nanoparticles — BULK

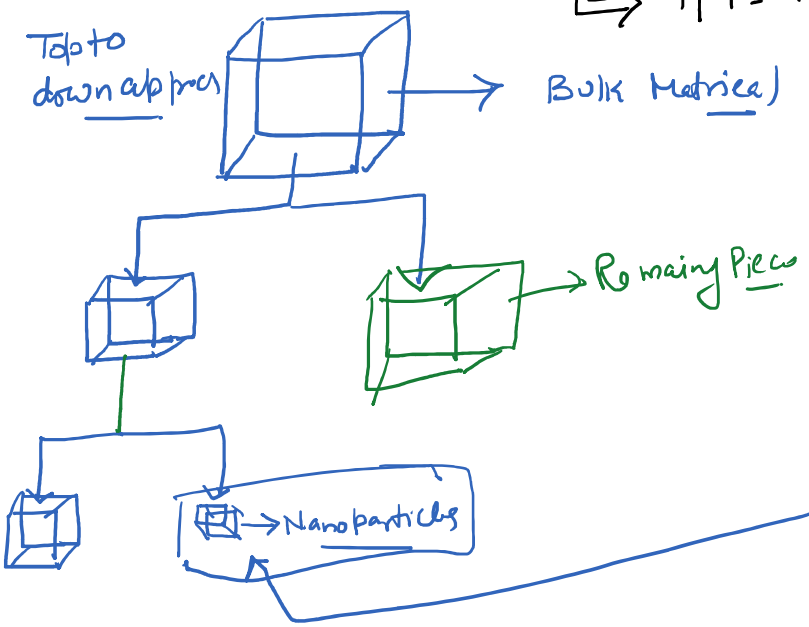
1 — 1 to 10 atoms — 10 – 10^6 atoms — $< 10^6$

Bulk ⇒ Greater than 10^6 atoms

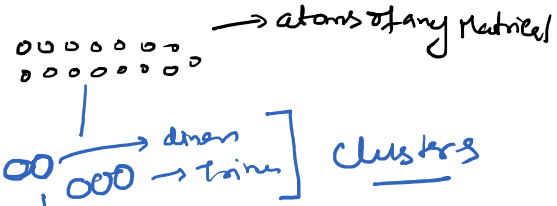
Nano ⇒ 10 — 10^6 atoms



↳ P_1 is having less atoms than P



(ii) Bottom-to-up approach

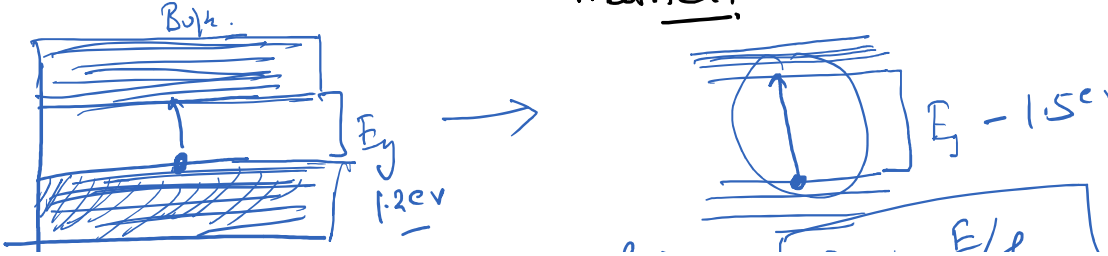


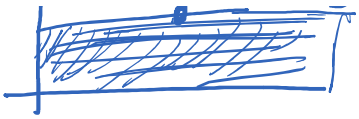
Quantum Confinement :—

Confinement :— Restricting something

Quantum :—

↳ Semiconductor — You reduced the size of semiconductor material.





$E = h\nu \Rightarrow \nu = E/h$

$E_g \propto \frac{1}{\text{Size}}$

When the length of semiconducter is reduced to the same order as Exciton Bohar radius ~ Few nanometer, then Quantum Confinment will occur there.

↳ Bohar Radius — Most probable distance between proton and Electron in a hydrogen atom.

$$a_0 = \frac{4\pi\varepsilon_0 \hbar^2}{m_e e^2} = 0.529\,A^0$$

↳ Homework:— Derive the Expression for Bohar Radius

(i) Degree of freedom — D_f

(ii) Degree of Constraints — D_c

Structures	—	D_c	—	D_f
(i) Bulk material	—	0	—	3
(ii) Quantum well	—	1	—	2
(iii) Quantum wire	—	2	—	1
(iv) Quantum Dot	—	3	—	0