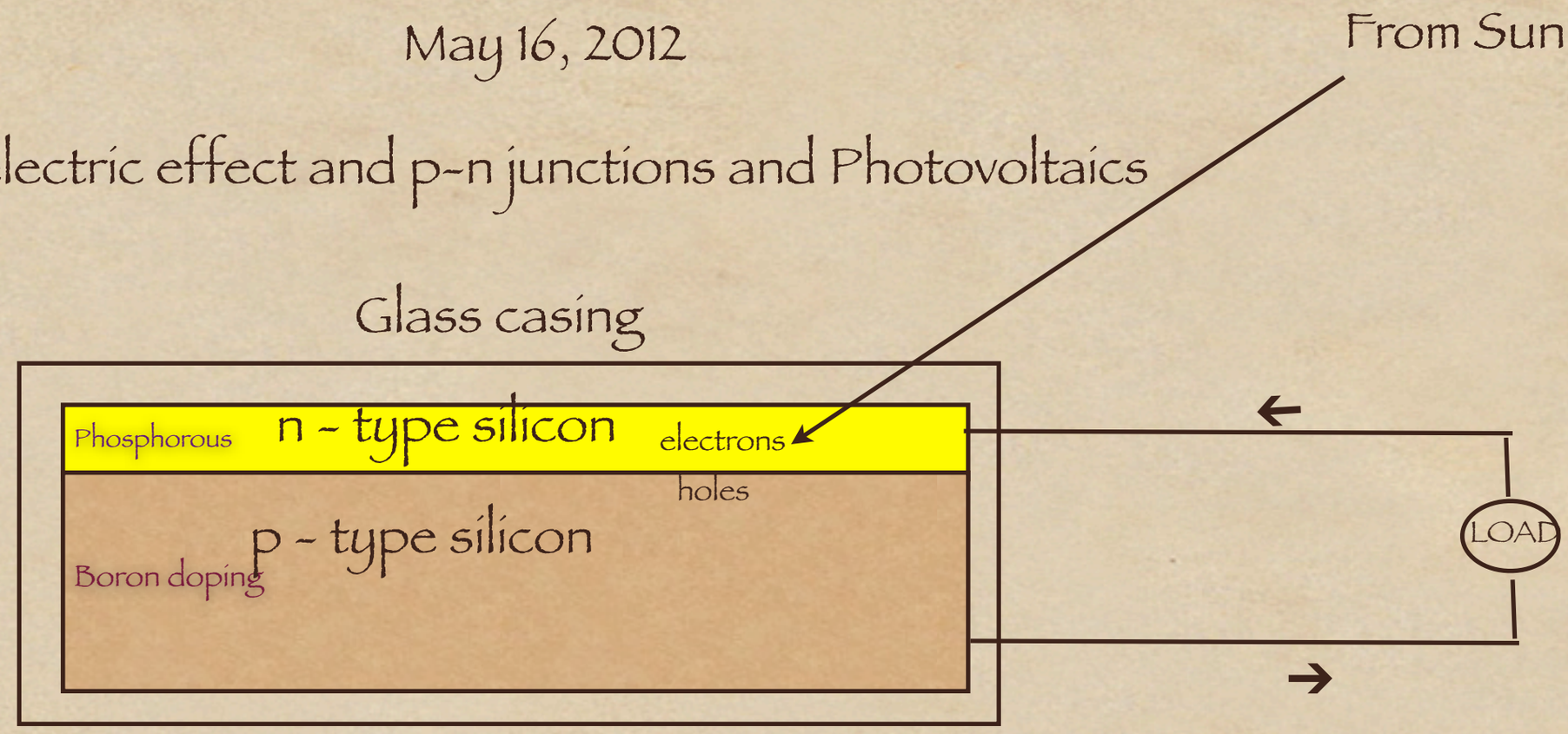
Lecture 19

May 16, 2012

Photoelectric effect and p-n junctions and Photovoltaics



http://www.pbs.org/wgbh/nova/solar/insi-nf.html

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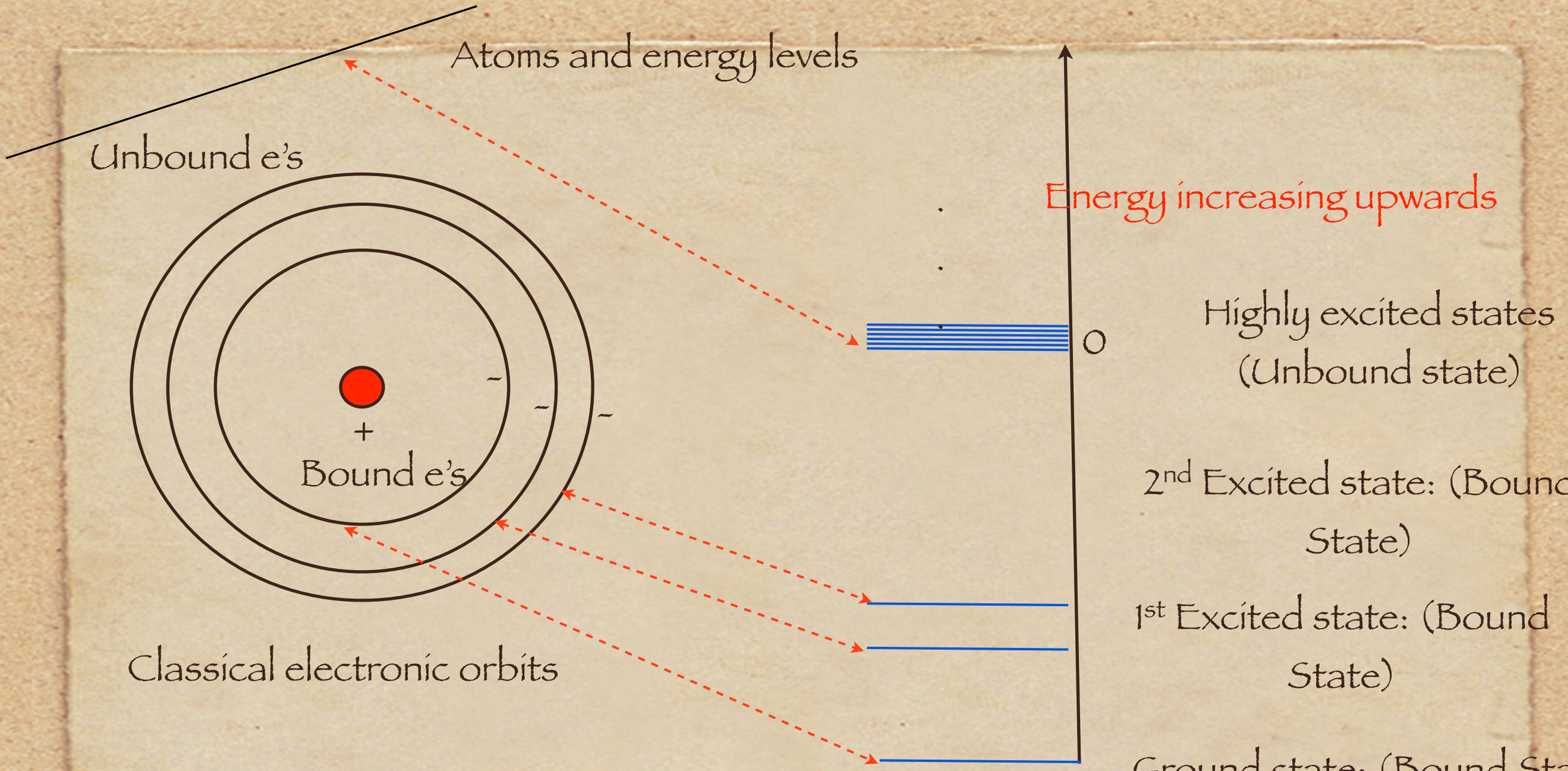
Atoms and energy levels



Modern picture of an atom.

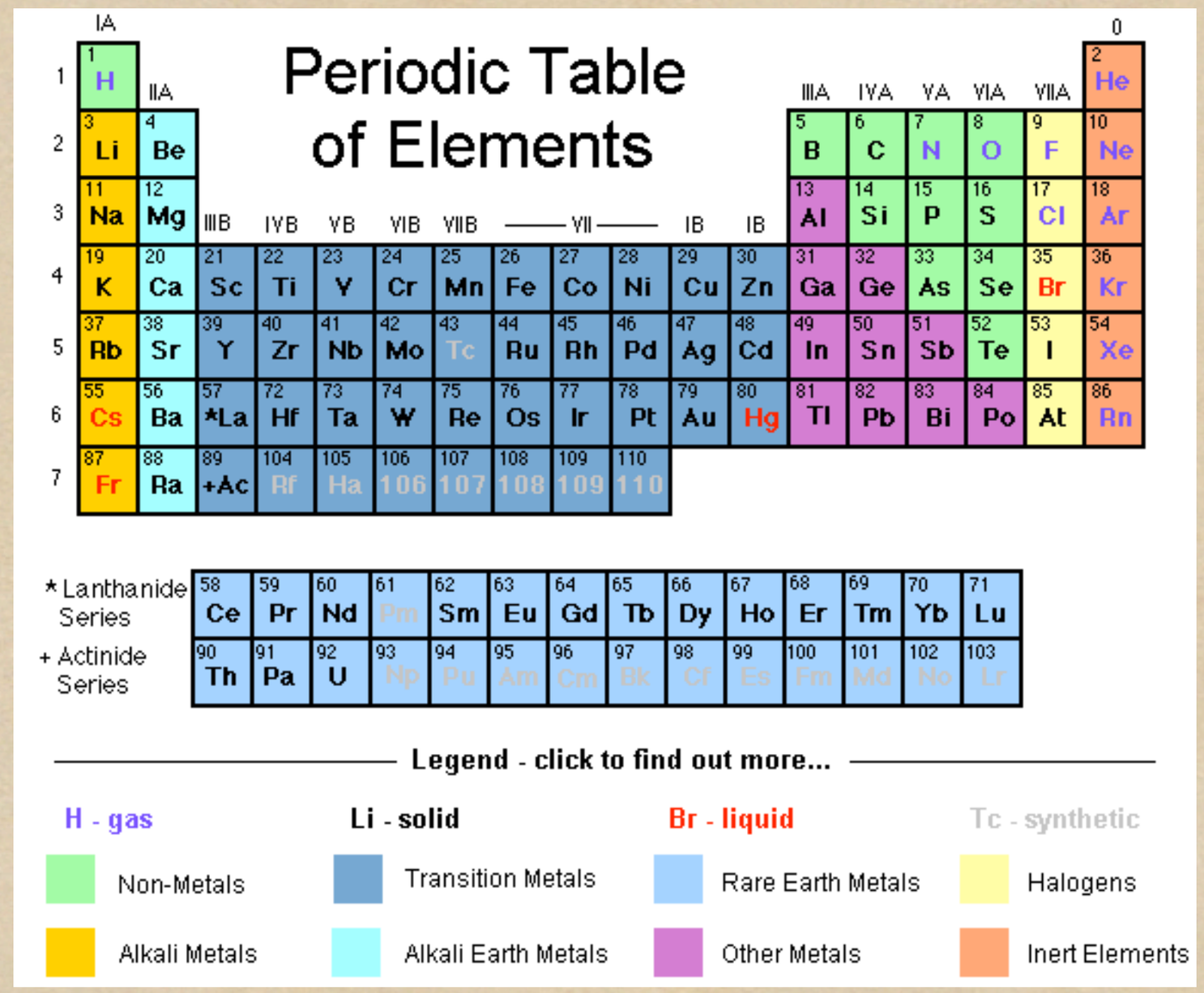
Bohr's old quantum theory as described in many books.

Excitation energies at resonance : $e_1 - e_2 = h\upsilon$

get related to specific wave lengths.

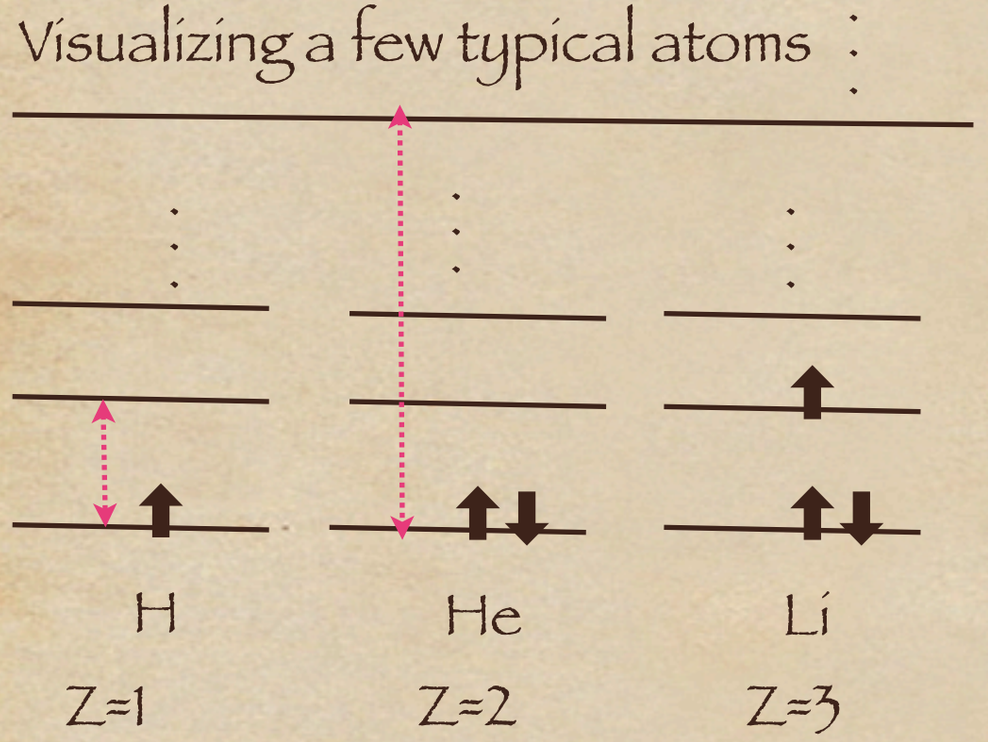
Atomic or molecular excitations dominate quantum efficiency of absorption (CO_2 problem)

Basic concept of metal and nonmetal-> semiconductor



- A bound state has an electron in "perpetual captivity" of an ion.
- Different bound states usually have different energies. However a given energy level can and does accomodate a fixed number of electrons. (2 for s, 6 for p, 10 for d etc).
- The number of bound states is usually infinity
- An unbound state corresponds to electrons that are free and not bound to an ion

Visualizing a few typical atoms



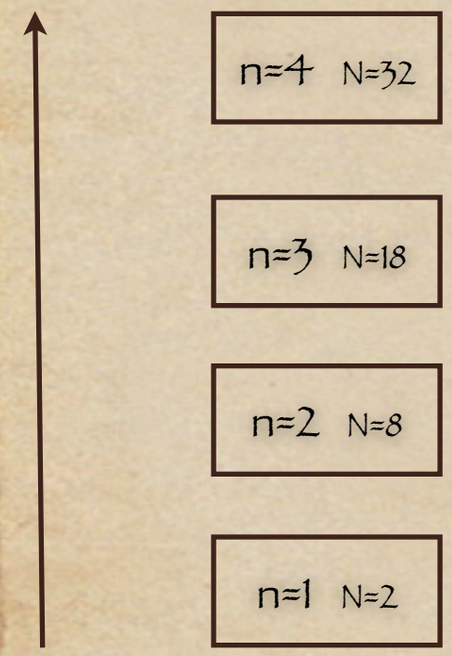
$$1\ eV = 1.6 \times 10^{-19}\ J = 8.066 \times 10^{5} m^{-1}$$

$$\Delta\varepsilon = h\ \nu = \ h\ c/\lambda$$

$$13.6\ eV \sim 10^{7} m^{-1} \rightarrow 1000\ A^{0}$$

Optical transitions:
Both ways (absorption or emission)

Energy increasing



atomic levels

n= Principal Q N
N= number or e's accomodated

Metal

Fermi level

Semiconductor

e.g. Si

Solid= array of atoms

Fermi Level= Energy of top most occupied energy level.