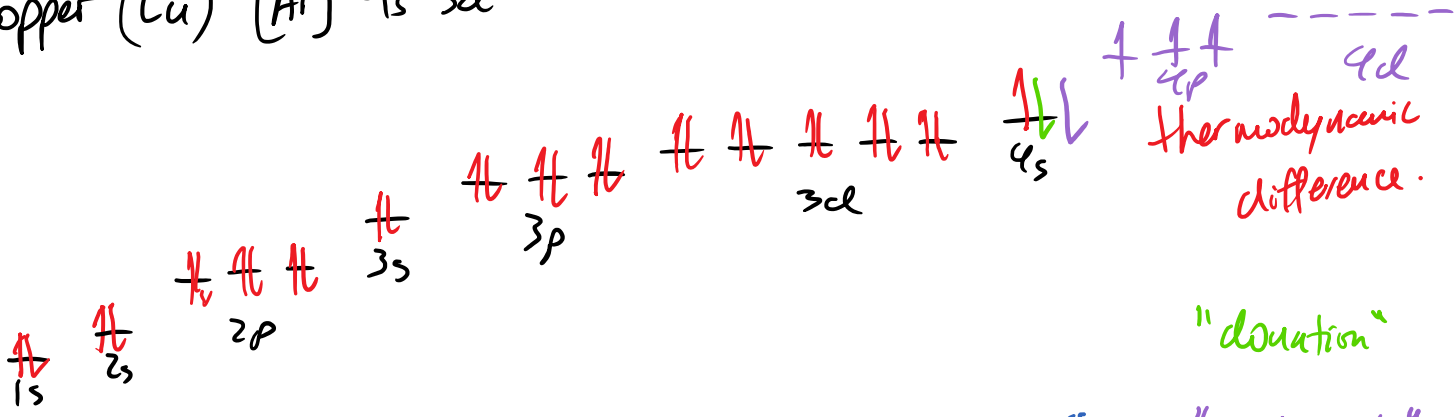
APS110H1f2024 November 11, 2024

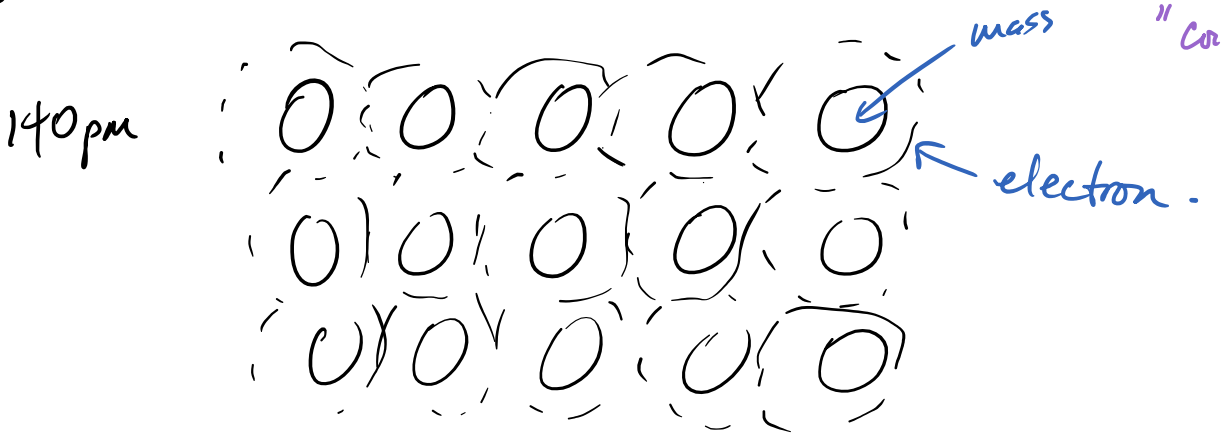
November 11, 2024 8:43 AM

Copper (Cu) [Ar] $4s^1 3d^{10}$



"donation"

"conductivity"



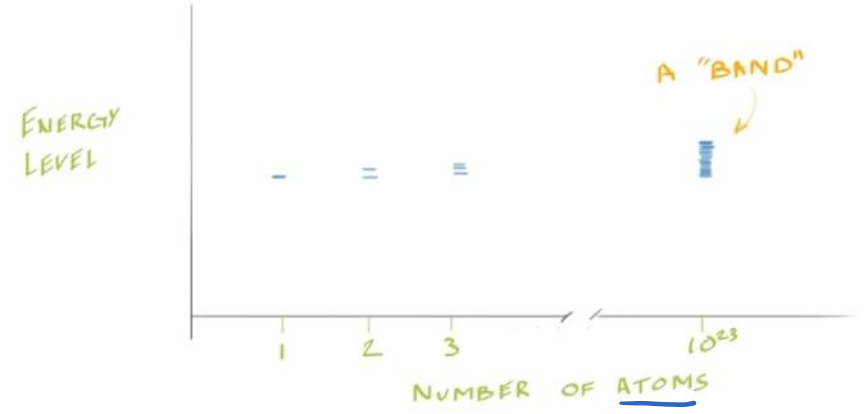


Figure 11. A schematic depiction of a particular energy level in an isolated atom, two atoms, three atoms, and so on up to a massive collection of atoms, as in a solid. The number of energy levels in a solid, for a corresponding single energy level in an isolated atom, is equal to the number of atoms, so that when we have a solid there are so many closely spaced energy levels as to be essentially continuous. We call this a band.

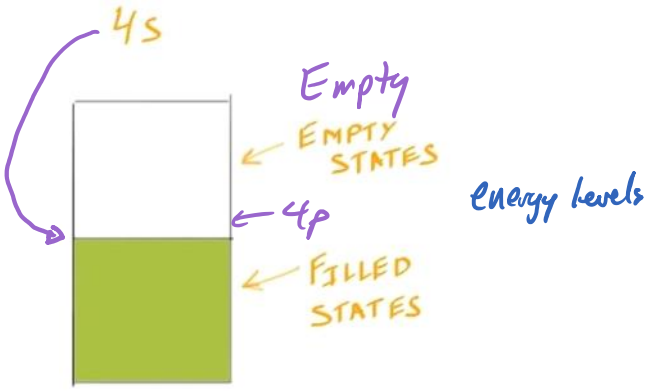


Figure 12. The band structure for copper.

Magnesium, Aluminum

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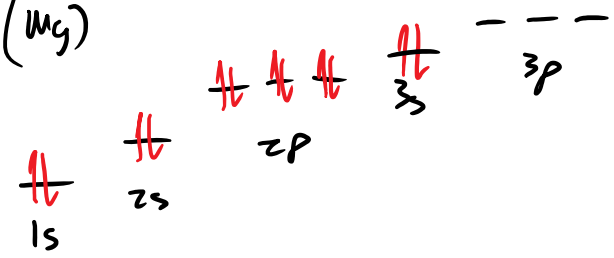
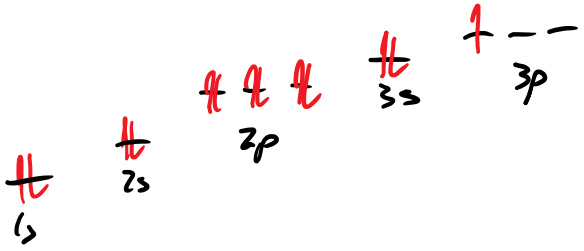
Magnesium (Mg) [Ne] $3s^2$ = $1s^2 2s^2 2p^6 3s^2 = Mg^0$



electric conductivity
- weak / not good
- semi-conductor

Aluminum (Al) [Ne] $3s^2 3p^1$ = Al^0



electric conductivity (back in the day)
- "ok" conductivity

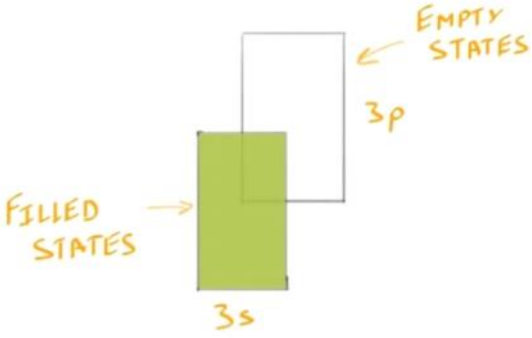


Figure 13. The band structure for magnesium.

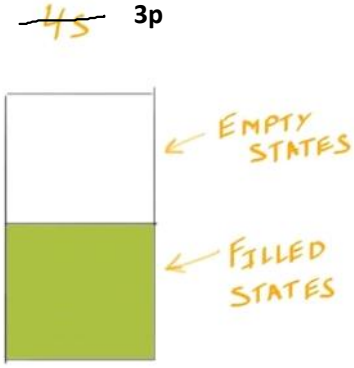


Figure 12. The band structure for ~~copper~~ aluminum

Metal, Salts... Octet rule

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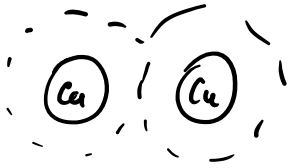
Octet rule "$ns^2\ np^6$" – "stable"/more stable $= 8$



copper

$4s^1\ 3d^{10}$

$3p^6\ 4s^1$ ~~ $3p^6\ 4s^2$

donation

4 – –

3s 3p

3+3 = 6

↑

donated

chlorine (Cl) $[Ne]\ 3s^2 3p^5 \xrightarrow{Cl^-} [Ne]\ 3s^2 3p^6$

fluorine (F) $[He]\ 2s^2 2p^5 \xrightarrow{F^-} [He]\ 3s^2 3p^6$

bromine (Br) $[Ar]\ 4s^2 3d^{10} 4p^5 \xrightarrow{Br^-} [Ar]\ 4s^2 3d^{10} 4p^6$

iodine (I) $[Kr]\ 5s^2 4d^{10} 5p^5 \xrightarrow{I^-} [Kr]\ 5s^2 4d^{10} 5p^6$

potassium (K) $[Ar]\ 4s^1$

$= 1s^2 2s^2 2p^6 3s^2 3p^6 4s^1 \xrightarrow{K^+} 1s^2 2s^2 2p^6 3s^2 3p^6$

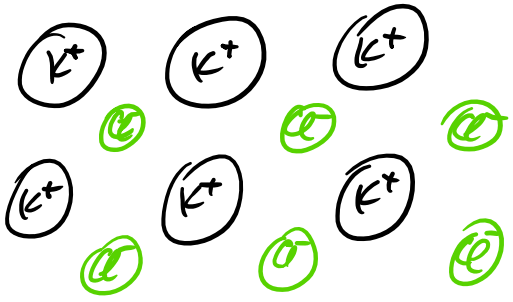
calcium (Ca) $= [Ar]\ 4s^2$

$= 1s^2 2s^2 2p^6 3s^2 3p^6 4s^2 \xrightarrow{Ca^{2+}} 1s^2 2s^2 2p^6 3s^2$

175 pm

KCl

275 pm

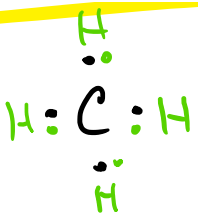


H

H : C : H

C $1s^2 2s^2 2p^2 \xrightarrow{4} 1s^2 2s^2 2p^6$

H



C $1s^2\ 2s^2\ 2p^2$ $\xrightarrow{4\ H}$ $1s^2\ 2s^2\ 2p^6$

Periodic Table - Electron Configuration

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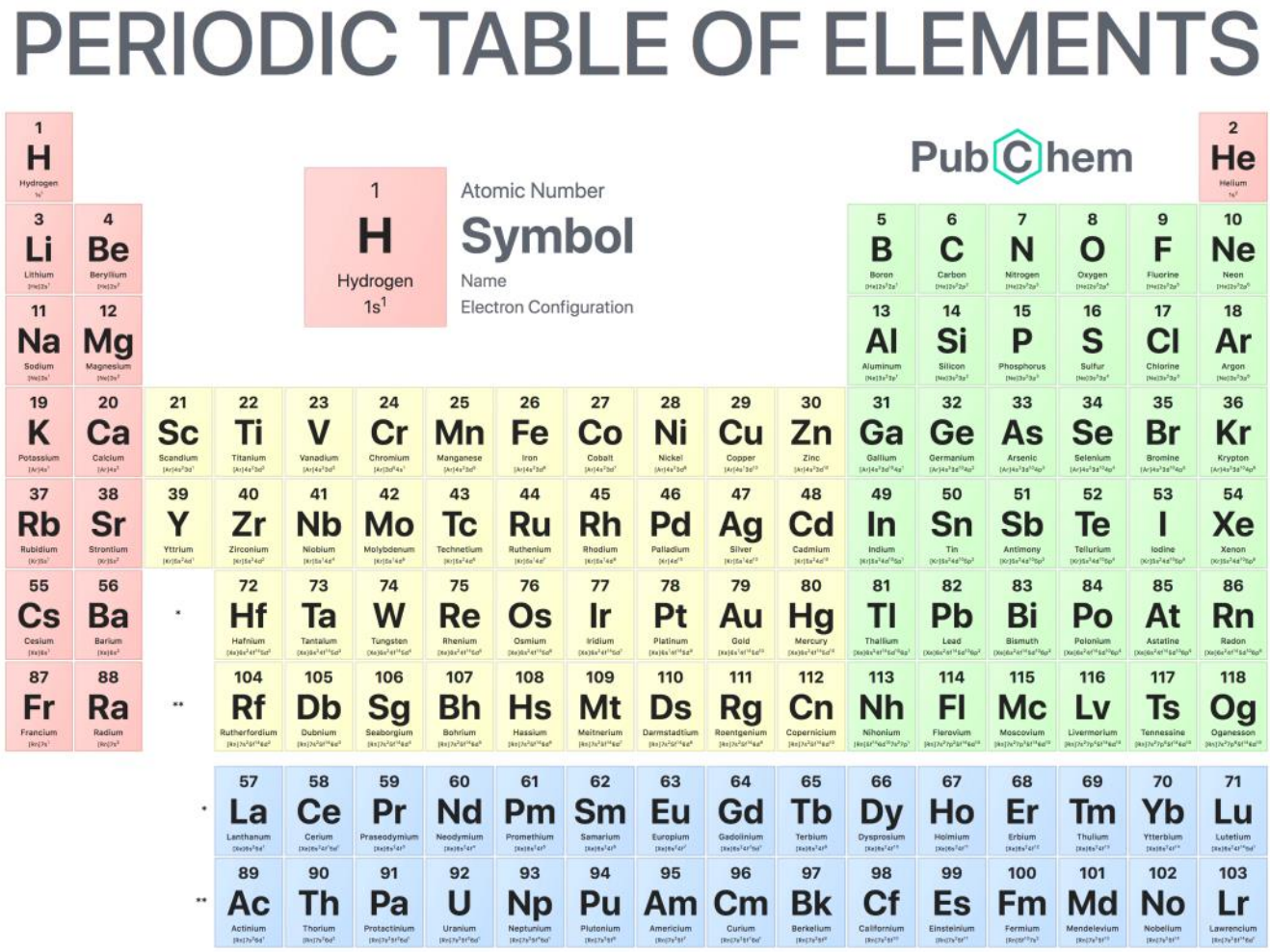
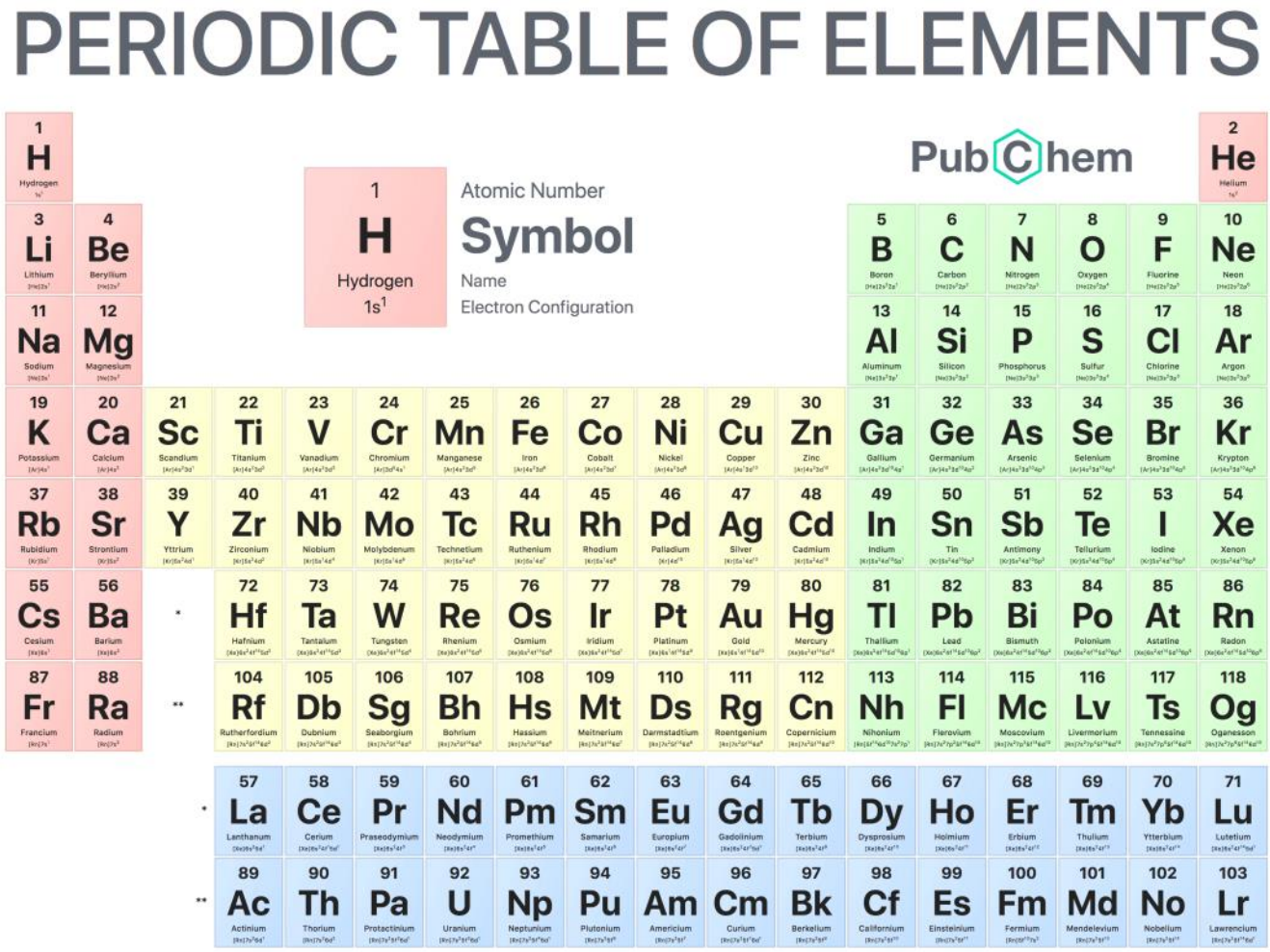


Periodic Table - Electron Configuration

November 8, 2024 2:00 PM



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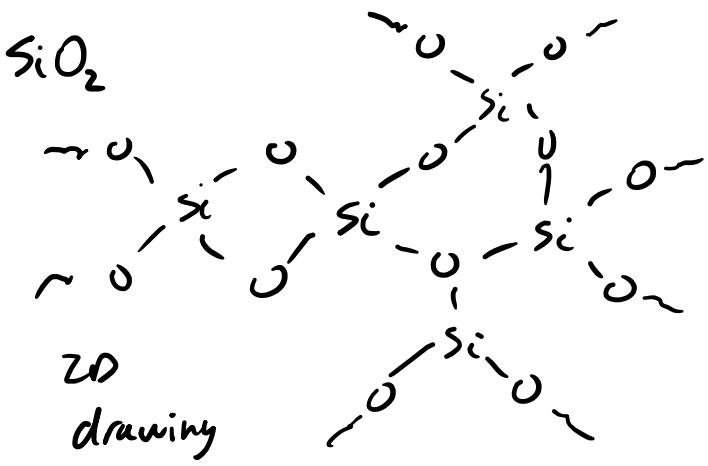
Insulators – ceramics – Al_2O_3 SiO_2 CuO TiO_2

Cu^{2+} O^{2-}

– $AlCl_3$



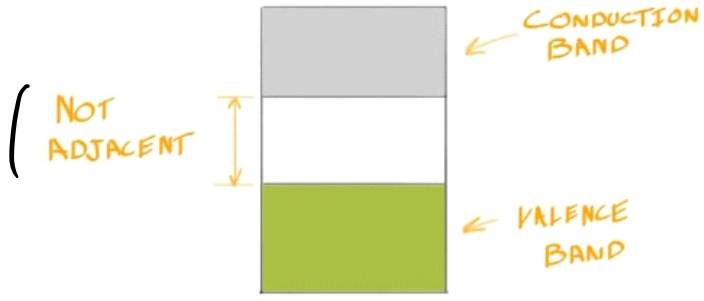


Figure 14. The band structure for an insulator, showing the valence and conduction bands with a large gap between them

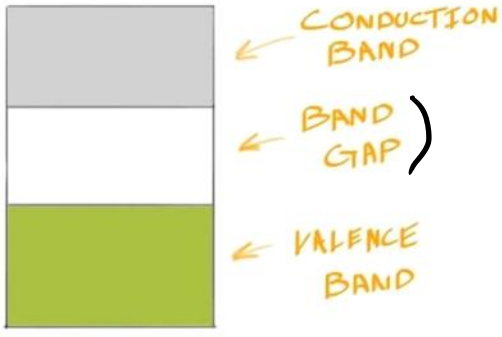


Figure 15. The band structure for an insulator, with the band gap identified as well as the valence and conduction bands.

Semiconductors

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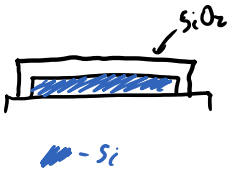
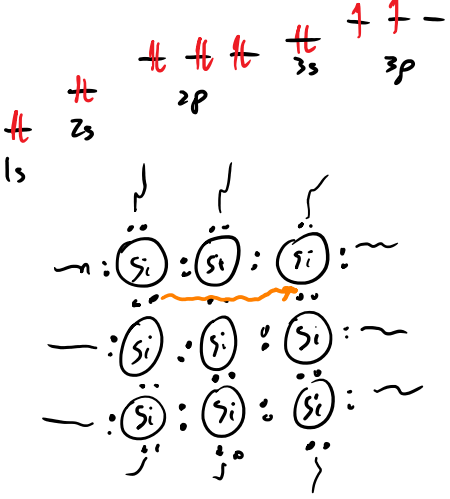


silicon

Si $[Ne]\,3s^2 3p^2$

$= 1s^2 2s^2 2p^6 3s^2 3p^2$



sp^3 hybrids

sp^3 hybridization "donated"

3s 3p

only when bonded.

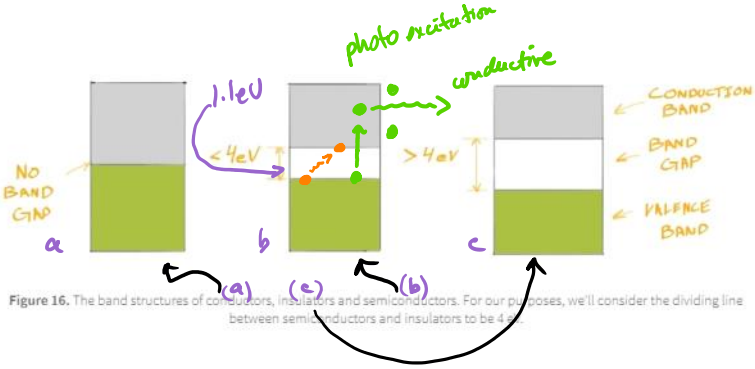


Figure 16. The band structures of conductors, insulators and semiconductors. For our purposes, we'll consider the dividing line between semiconductors and insulators to be 4 eV.

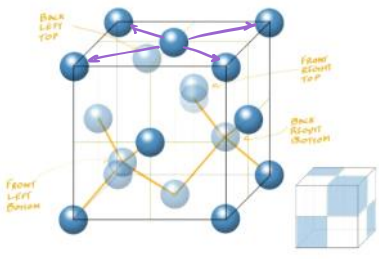


Figure 19. The structure of diamond cubic. This structure can be thought of as an FCC lattice of atoms with the same atoms occupying half of the available tetrahedral interstitial sites, in alternating positions. The alternating positions are illustrated with the shaded "sub-cube" faces in the second cube.

Periodic Table - Electron Configuration

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