

Insulators

- ceramics - Al_2O_3 SiO_2 CuO TiO_2

- $AlCl_3$

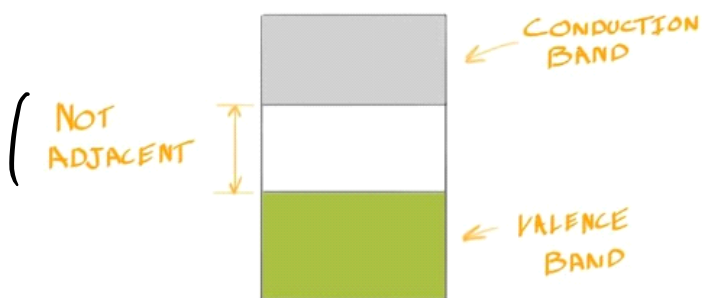
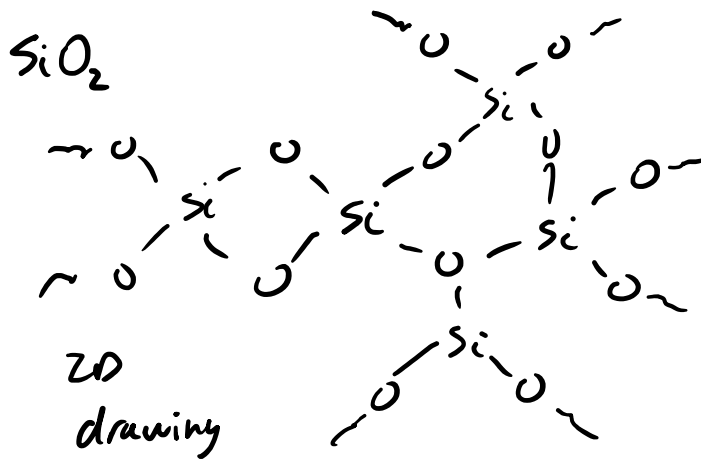


Figure 14. The band structure for an insulator, showing the valence and conduction bands with a large gap between them

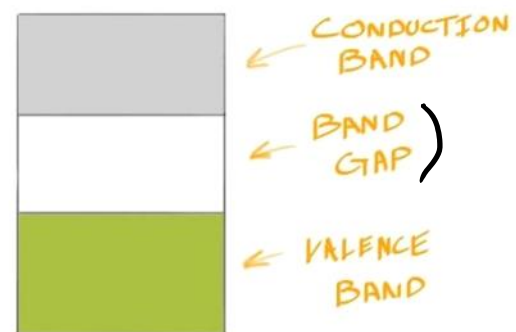
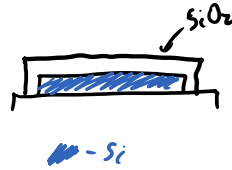
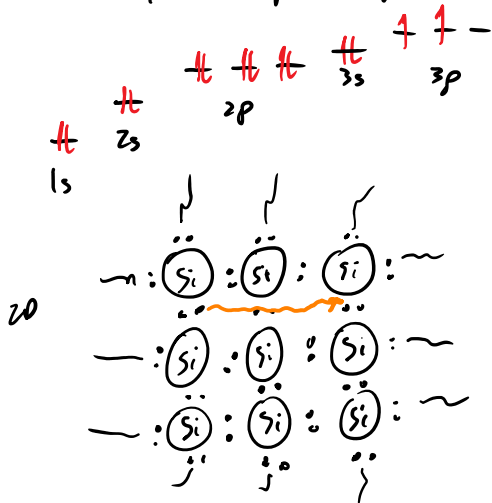
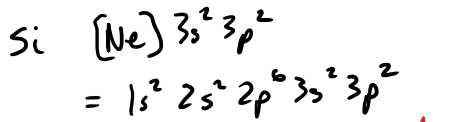


Figure 15. The band structure for an insulator, with the band gap identified as well as the valence and conduction bands.



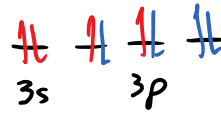
silicon



sp^3 hybrids

sp^3 hybridization

"donated"



only when bonded.

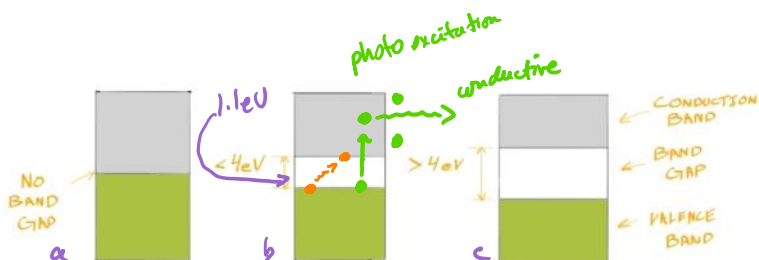


Figure 16. The band structures of conductors, insulators and semiconductors. For our purposes, we'll consider the dividing line between semiconductors and insulators to be 4 eV.

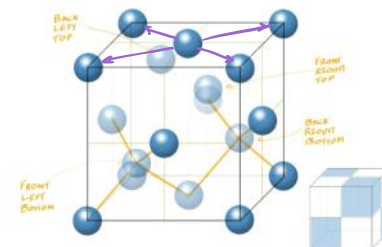


Figure 19. The structure of diamond cubic. This structure can be thought of as an FCC lattice of atoms with the same atoms occupying half of the available tetrahedral interstitial sites, in alternating positions. The alternating positions are illustrated with the shaded 'sub-cube' faces in the second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



PERIODIC TABLE OF ELEMENTS

<div>PubChem</div>																		2 He Helium 1s ²																	
1 H Hydrogen 1s ¹		<div>1 H Hydrogen 1s¹</div> <div>Atomic Number Symbol Name Electron Configuration</div>																																	
3 Li Lithium [He]2s ¹		4 Be Beryllium [He]2s ²																				5 B Boron [He]2s ² 2p ¹		6 C Carbon [He]2s ² 2p ²		7 N Nitrogen [He]2s ² 2p ³		8 O Oxygen [He]2s ² 2p ⁴		9 F Fluorine [He]2s ² 2p ⁵		10 Ne Neon [He]2s ² 2p ⁶			
11 Na Sodium [Ne]3s ¹		12 Mg Magnesium [Ne]3s ²																				13 Al Aluminum [Ne]3s ² 3p ¹		14 Si Silicon [Ne]3s ² 3p ²		15 P Phosphorus [Ne]3s ² 3p ³		16 S Sulfur [Ne]3s ² 3p ⁴		17 Cl Chlorine [Ne]3s ² 3p ⁵		18 Ar Argon [Ne]3s ² 3p ⁶			
19 K Potassium [Ar]4s ¹		20 Ca Calcium [Ar]4s ²		21 Sc Scandium [Ar]3d ¹ 4s ²		22 Ti Titanium [Ar]3d ² 4s ²		23 V Vanadium [Ar]3d ³ 4s ²		24 Cr Chromium [Ar]3d ⁵ 4s ¹		25 Mn Manganese [Ar]3d ⁵ 4s ²		26 Fe Iron [Ar]3d ⁶ 4s ²		27 Co Cobalt [Ar]3d ⁷ 4s ²		28 Ni Nickel [Ar]3d ⁸ 4s ²		29 Cu Copper [Ar]3d ¹⁰ 4s ¹		30 Zn Zinc [Ar]3d ¹⁰ 4s ²		31 Ga Gallium [Ar]3d ¹⁰ 4s ² 4p ¹		32 Ge Germanium [Ar]3d ¹⁰ 4s ² 4p ²		33 As Arsenic [Ar]3d ¹⁰ 4s ² 4p ³		34 Se Selenium [Ar]3d ¹⁰ 4s ² 4p ⁴		35 Br Bromine [Ar]3d ¹⁰ 4s ² 4p ⁵		36 Kr Krypton [Ar]3d ¹⁰ 4s ² 4p ⁶	
37 Rb Rubidium [Kr]5s ¹		38 Sr Strontium [Kr]5s ²		39 Y Yttrium [Kr]4d ¹ 5s ²		40 Zr Zirconium [Kr]4d ² 5s ²		41 Nb Niobium [Kr]4d ⁴ 5s ¹		42 Mo Molybdenum [Kr]4d ⁵ 5s ¹		43 Tc Technetium [Kr]4d ⁵ 5s ²		44 Ru Ruthenium [Kr]4d ⁷ 5s ¹		45 Rh Rhodium [Kr]4d ⁸ 5s ¹		46 Pd Palladium [Kr]4d ¹⁰		47 Ag Silver [Kr]4d ¹⁰ 5s ¹		48 Cd Cadmium [Kr]4d ¹⁰ 5s ²		49 In Indium [Kr]4d ¹⁰ 5s ² 5p ¹		50 Sn Tin [Kr]4d ¹⁰ 5s ² 5p ²		51 Sb Antimony [Kr]4d ¹⁰ 5s ² 5p ³		52 Te Tellurium [Kr]4d ¹⁰ 5s ² 5p ⁴		53 I Iodine [Kr]4d ¹⁰ 5s ² 5p ⁵		54 Xe Xenon [Kr]4d ¹⁰ 5s ² 5p ⁶	
55 Cs Cesium [Xe]6s ¹		56 Ba Barium [Xe]6s ²		* 		72 Hf Hafnium [Xe]4f ¹⁴ 5d ² 6s ²		73 Ta Tantalum [Xe]4f ¹⁴ 5d ³ 6s ²		74 W Tungsten [Xe]4f ¹⁴ 5d ⁴ 6s ²		75 Re Rhenium [Xe]4f ¹⁴ 5d ⁵ 6s ²		76 Os Osmium [Xe]4f ¹⁴ 5d ⁶ 6s ²		77 Ir Iridium [Xe]4f ¹⁴ 5d ⁷ 6s ²		78 Pt Platinum [Xe]4f ¹⁴ 5d ⁹ 6s ¹		79 Au Gold [Xe]4f ¹⁴ 5d ¹⁰ 6s ¹		80 Hg Mercury [Xe]4f ¹⁴ 5d ¹⁰ 6s ²		81 Tl Thallium [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ¹		82 Pb Lead [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ²		83 Bi Bismuth [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ³		84 Po Polonium [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁴		85 At Astatine [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁵		86 Rn Radon [Xe]4f ¹⁴ 5d ¹⁰ 6s ² 6p ⁶	
87 Fr Francium [Rn]7s ¹		88 Ra Radium [Rn]7s ²		** 		104 Rf Rutherfordium [Rn]5f ¹⁴ 6d ² 7s ²		105 Db Dubnium [Rn]5f ¹⁴ 6d ³ 7s ²		106 Sg Seaborgium [Rn]5f ¹⁴ 6d ⁴ 7s ²		107 Bh Bohrium [Rn]5f ¹⁴ 6d ⁵ 7s ²		108 Hs Hassium [Rn]5f ¹⁴ 6d ⁶ 7s ²		109 Mt Meitnerium [Rn]5f ¹⁴ 6d ⁷ 7s ²		110 Ds Darmstadtium [Rn]5f ¹⁴ 6d ⁸ 7s ²		111 Rg Roentgenium [Rn]5f ¹⁴ 6d ⁹ 7s ²		112 Cn Copernicium [Rn]5f ¹⁴ 6d ¹⁰ 7s ²		113 Nh Nihonium [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ¹		114 Fl Flerovium [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ²		115 Mc Moscovium [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ³		116 Lv Livermorium [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁴		117 Ts Tennessine [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁵		118 Og Oganesson [Rn]5f ¹⁴ 6d ¹⁰ 7s ² 7p ⁶	
		* 		57 La Lanthanum [Xe]5d ¹ 6s ²		58 Ce Cerium [Xe]4f ¹ 5d ¹ 6s ²		59 Pr Praseodymium [Xe]4f ³ 6s ²		60 Nd Neodymium [Xe]4f ⁴ 6s ²		61 Pm Promethium [Xe]4f ⁵ 6s ²		62 Sm Samarium [Xe]4f ⁶ 6s ²		63 Eu Europium [Xe]4f ⁷ 6s ²		64 Gd Gadolinium [Xe]4f ⁷ 5d ¹ 6s ²		65 Tb Terbium [Xe]4f ⁹ 6s ²		66 Dy Dysprosium [Xe]4f ¹⁰ 6s ²		67 Ho Holmium [Xe]4f ¹¹ 6s ²		68 Er Erbium [Xe]4f ¹² 6s ²		69 Tm Thulium [Xe]4f ¹³ 6s ²		70 Yb Ytterbium [Xe]4f ¹⁴ 6s ²		71 Lu Lutetium [Xe]4f ¹⁴ 5d ¹ 6s ²			
		** 		89 Ac Actinium [Rn]6d ¹ 7s ²		90 Th Thorium [Rn]6d ² 7s ²		91 Pa Protactinium [Rn]5f ² 6d ¹ 7s ²		92 U Uranium [Rn]5f ³ 6d ¹ 7s ²		93 Np Neptunium [Rn]5f ⁴ 6d ¹ 7s ²		94 Pu Plutonium [Rn]5f ⁶ 7s ²		95 Am Americium [Rn]5f ⁷ 7s ²		96 Cm Curium [Rn]5f ⁸ 7s ²		97 Bk Berkelium [Rn]5f ⁹ 7s ²		98 Cf Californium [Rn]5f ¹⁰ 7s ²		99 Es Einsteinium [Rn]5f ¹¹ 7s ²		100 Fm Fermium [Rn]5f ¹² 7s ²		101 Md Mendelevium [Rn]5f ¹³ 7s ²		102 No Nobelium [Rn]5f ¹⁴ 7s ²		103 Lr Lawrencium [Rn]5f ¹⁴ 6d ¹ 7s ²			