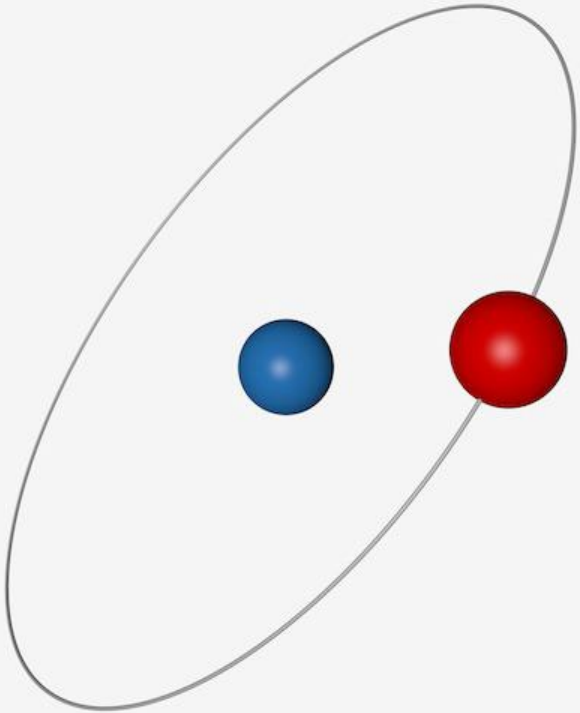
Working Principle of a Semiconductor Based Solar Cell

Band Gap I - Electrons in Atoms

Week 2.2.1

Arno Smets

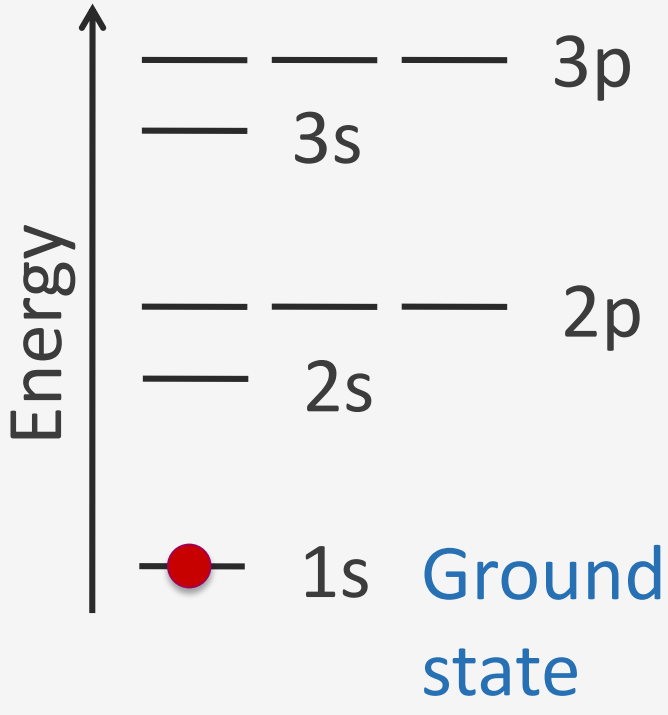
Hydrogen

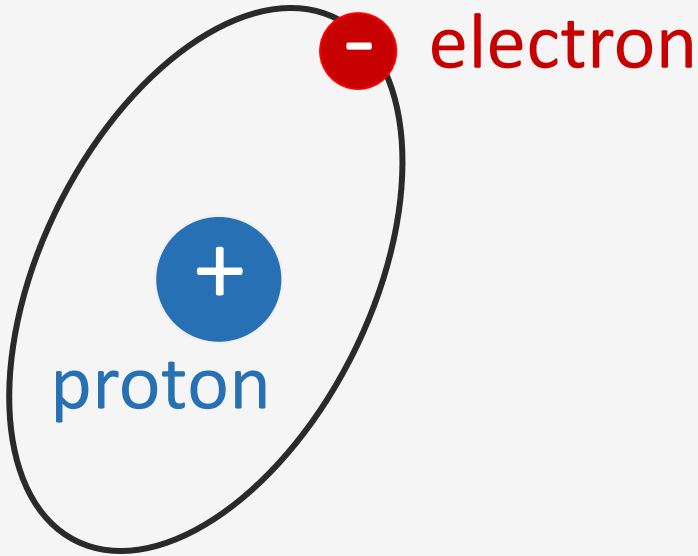


Proton (+)

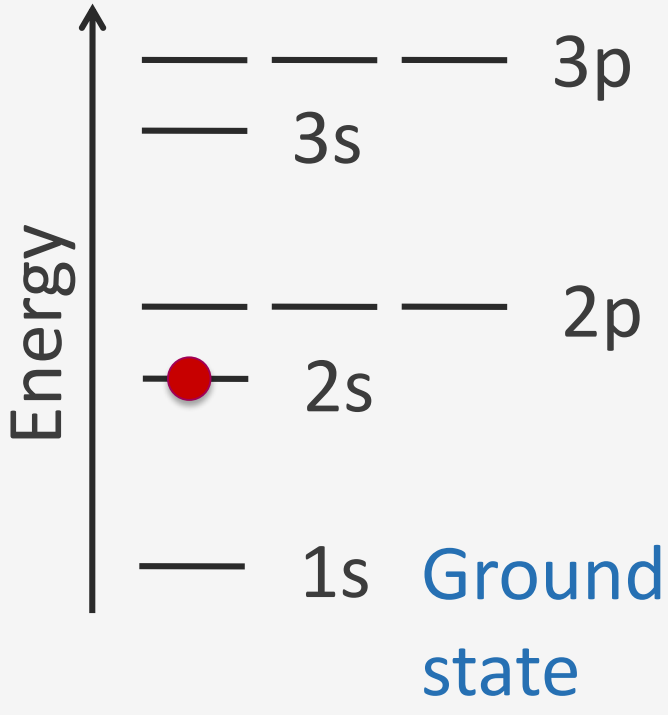
Electron (-)

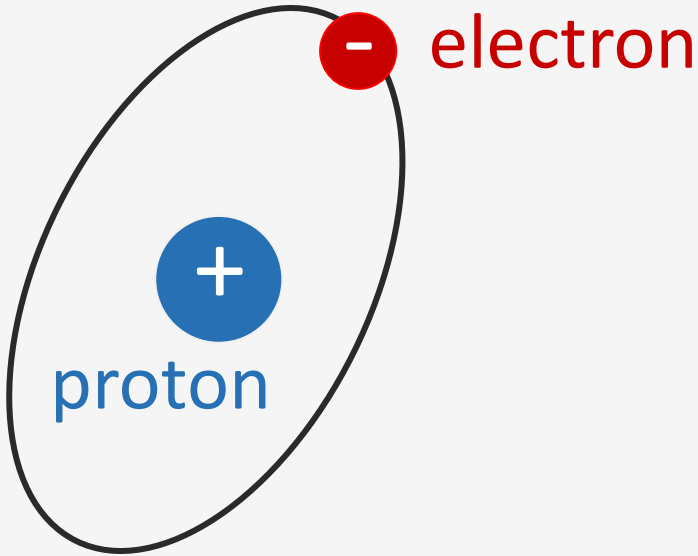
How strong are electrons bonded: the H atom



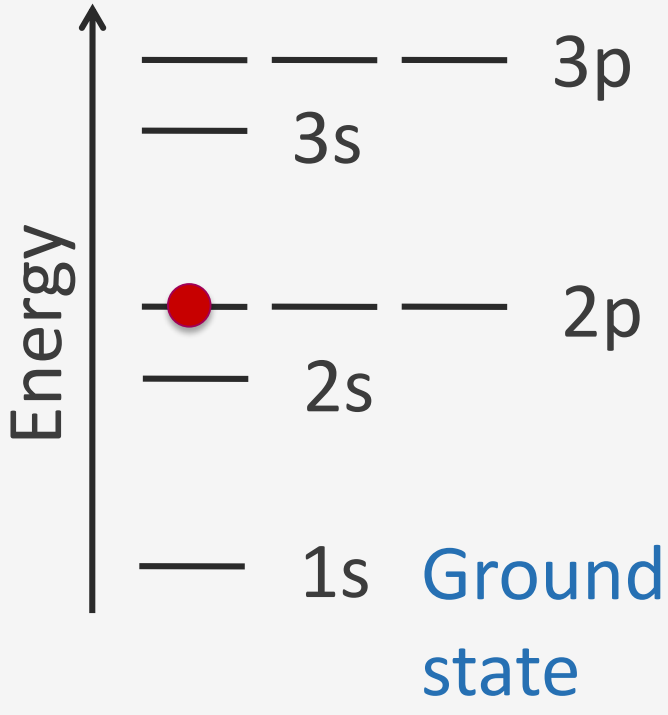


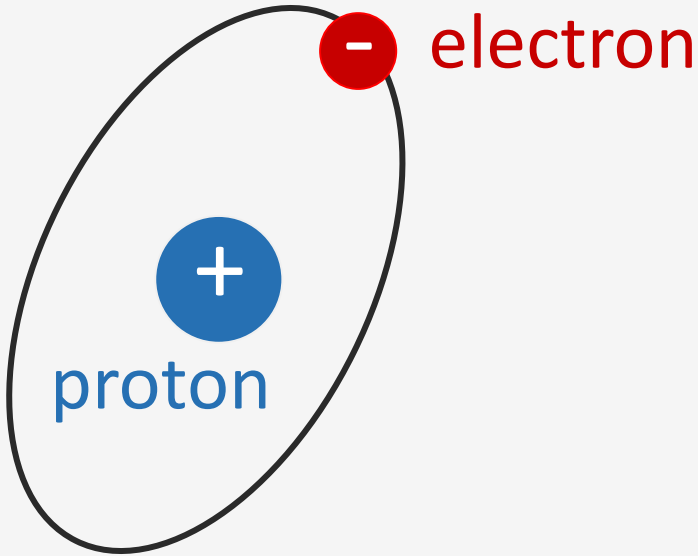
How strong are electrons bonded: the H atom



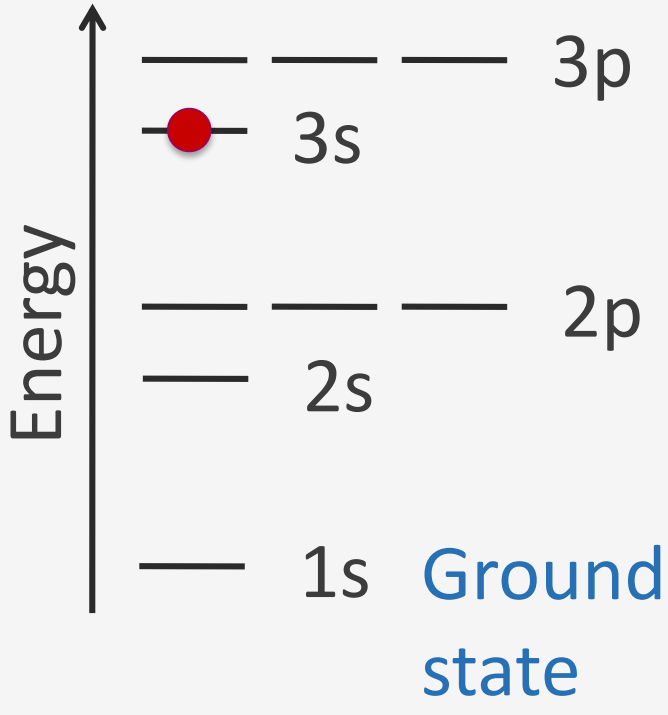


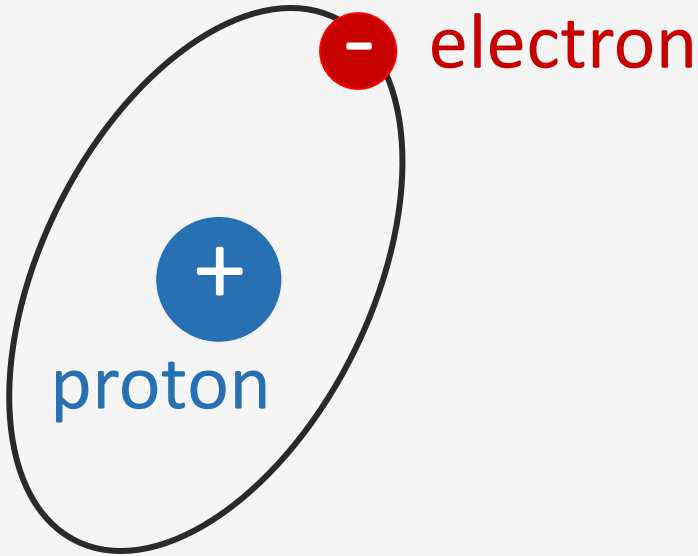
How strong are electrons bonded: the H atom



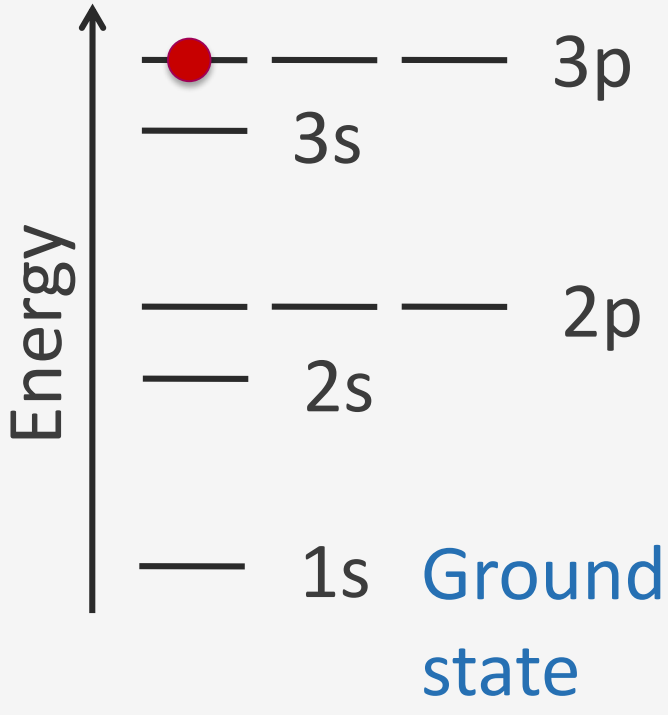


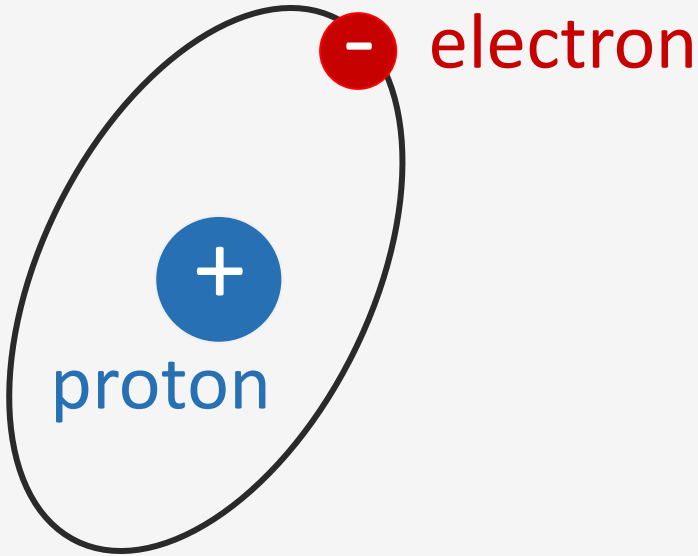
How strong are electrons bonded: the H atom



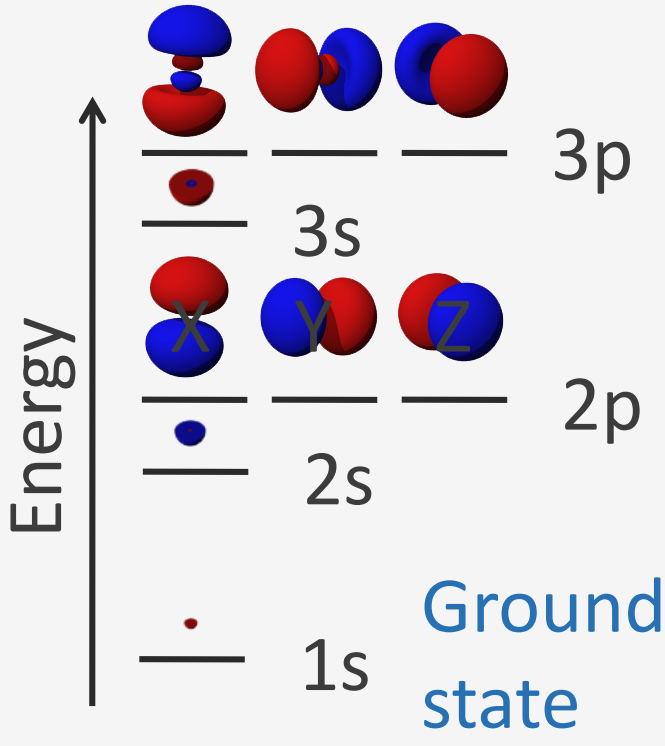


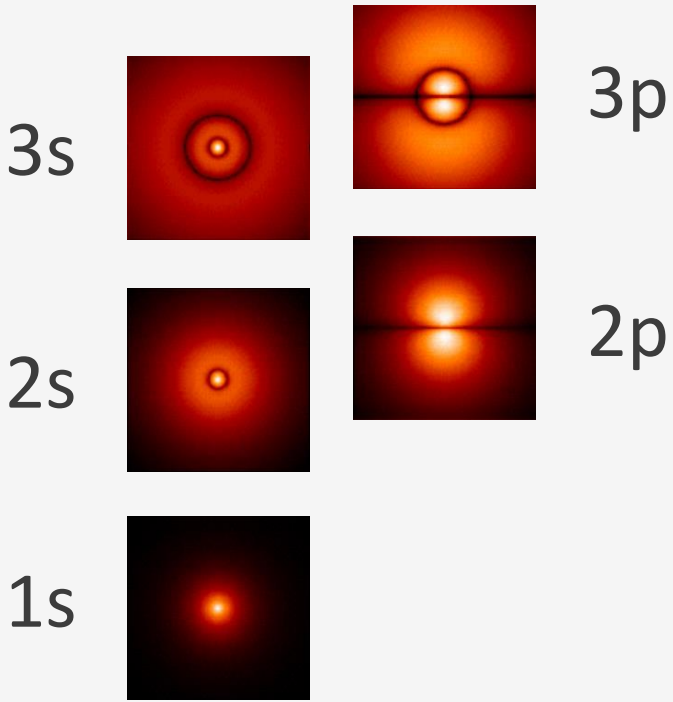
How strong are electrons bonded: the H atom



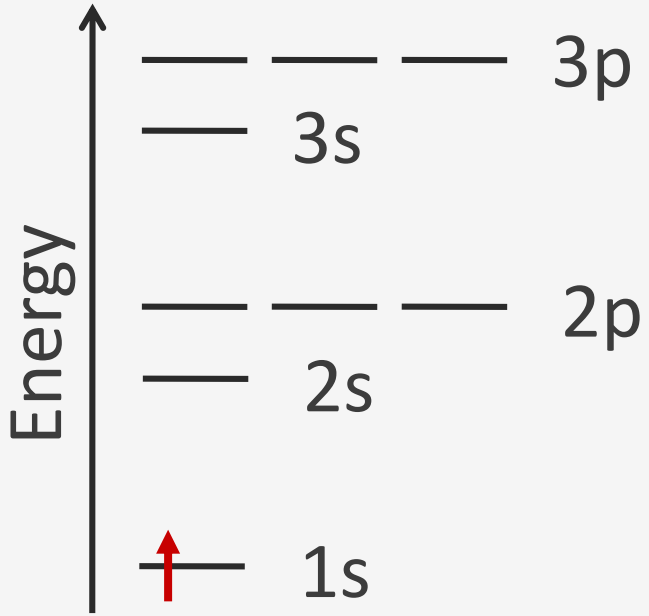


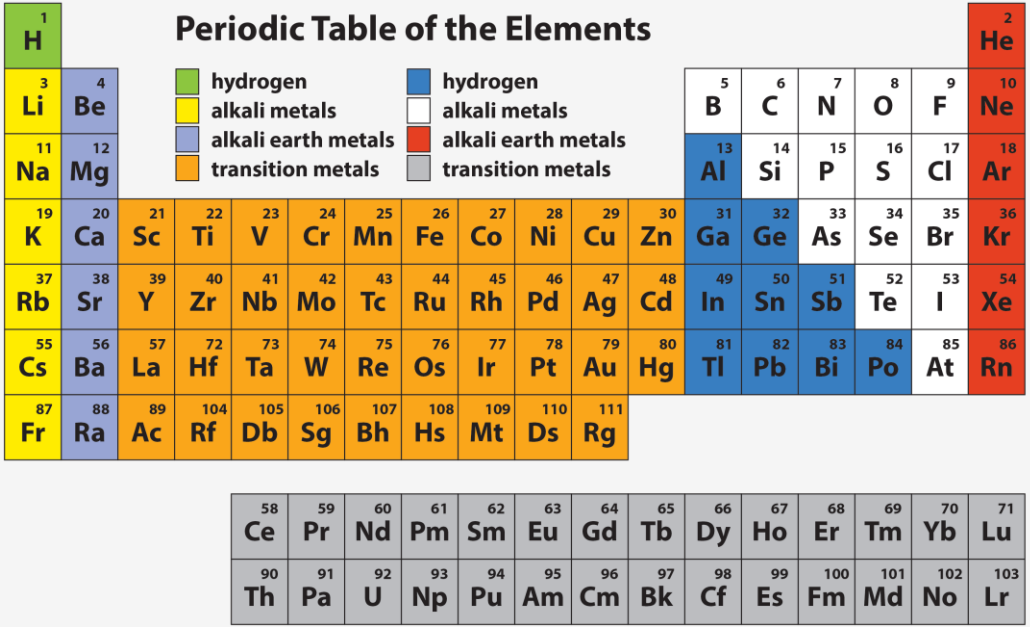
How strong are electrons bonded: the H atom



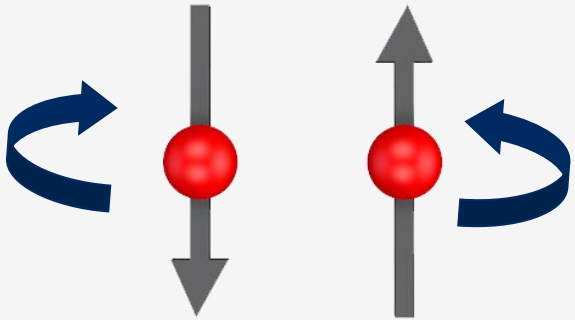


How strong are electrons bonded

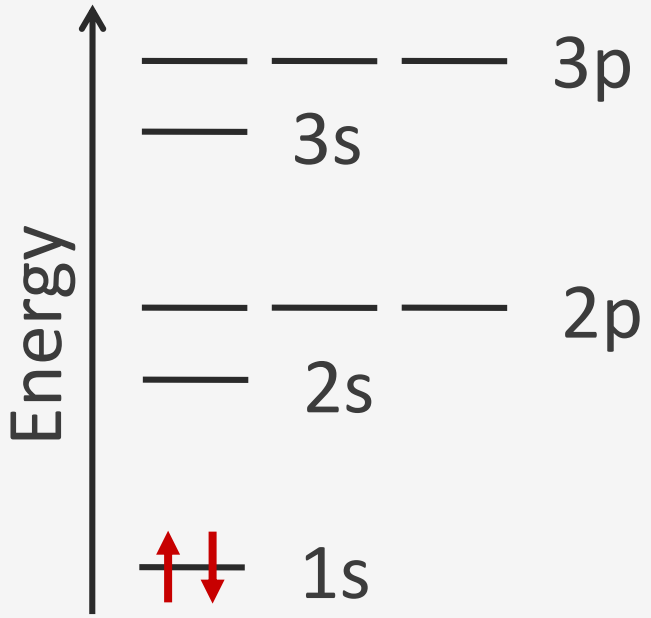


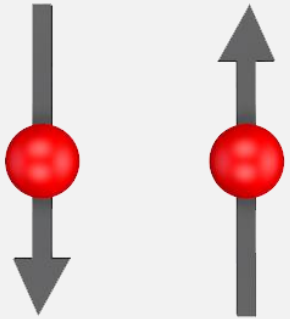


Electron spin



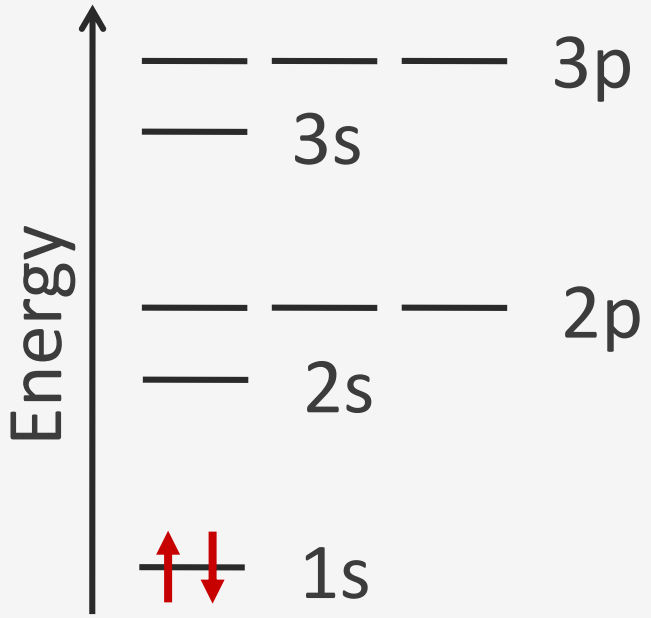
How strong are electrons bonded:

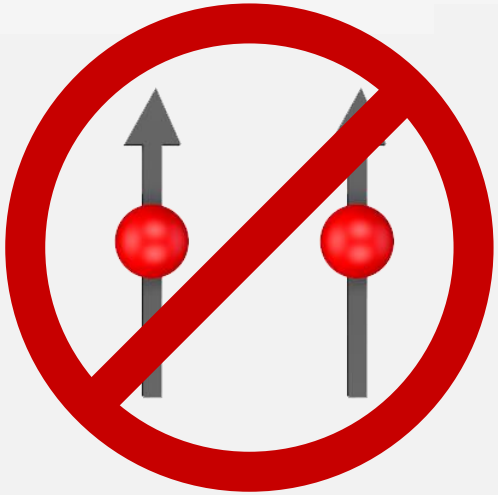




Pauli principle: two identical electrons can not occupy the same quantum state simultaneously.

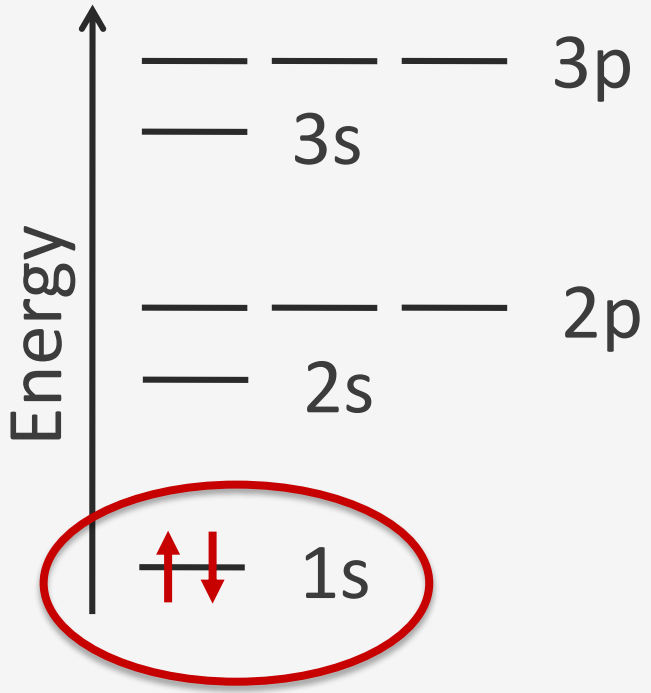
Pauli's Exclusion Principle:

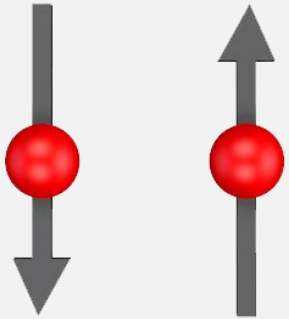




Pauli principle: two identical electrons can not occupy the same quantum state simultaneously.

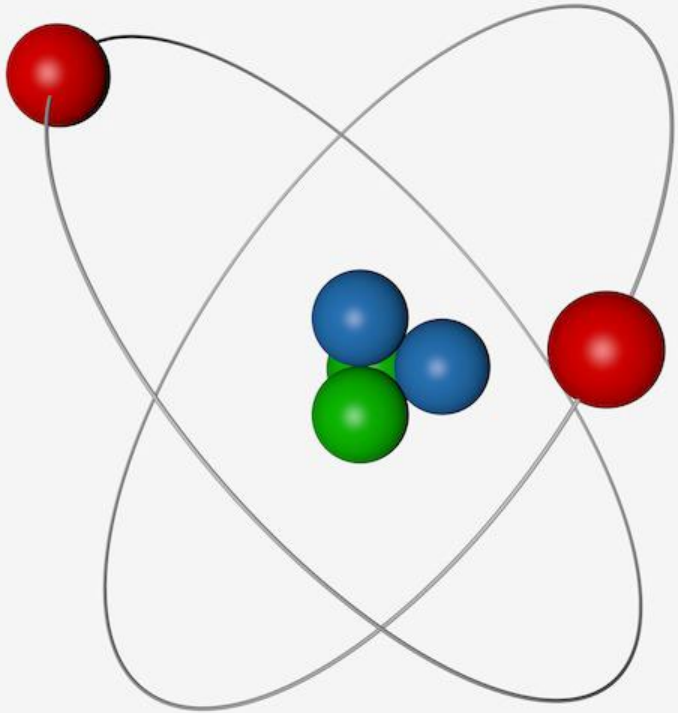
How strong are electrons bonded:



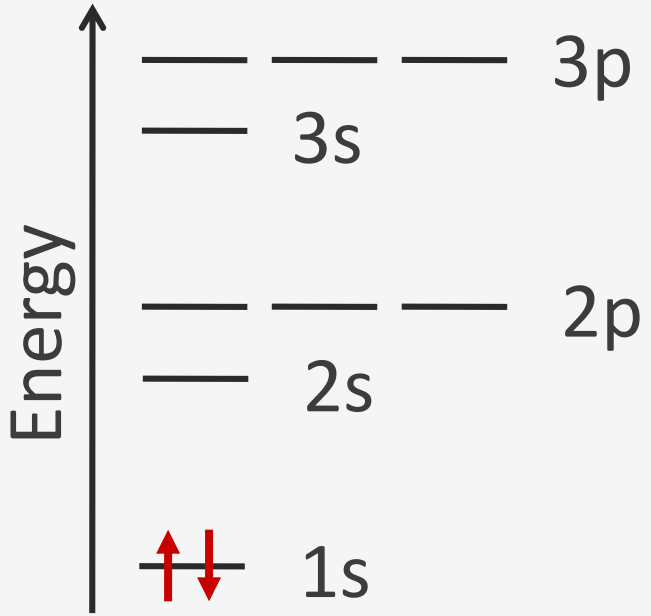


Pauli principle: two identical electrons can not occupy the same quantum state simultaneously.

Helium



How strong are electrons bonded

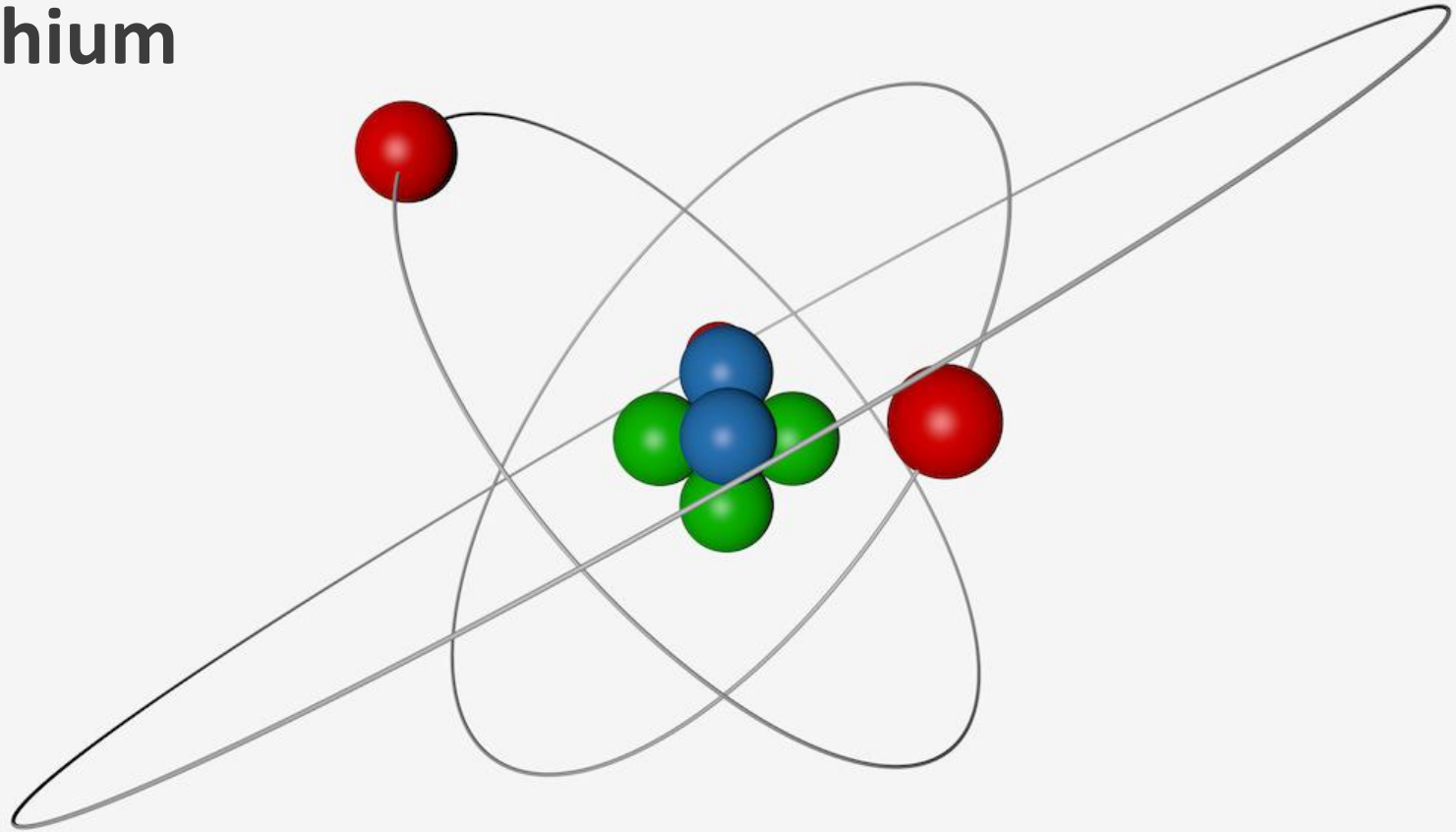


Periodic Table of the Elements

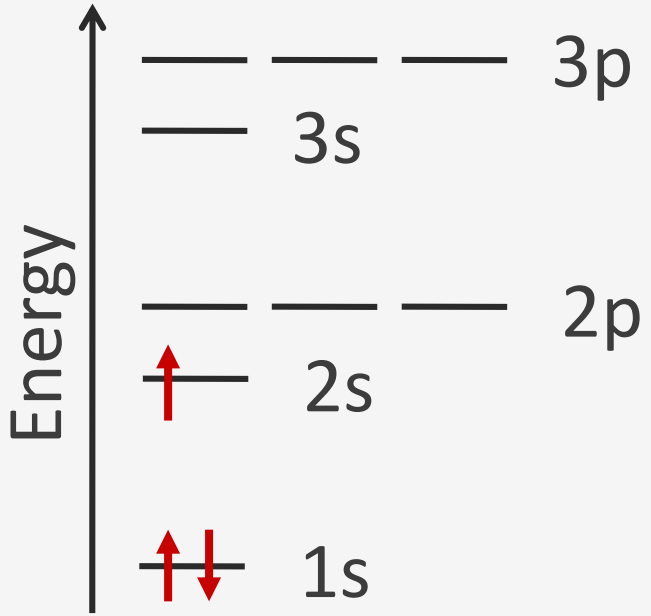
hydrogen	hydrogen
alkali metals	alkali metals
alkali earth metals	alkali earth metals
transition metals	transition metals

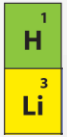
$He \rightarrow 1s^2$

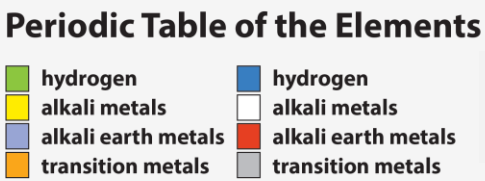
Lithium



How strong are electrons bonded

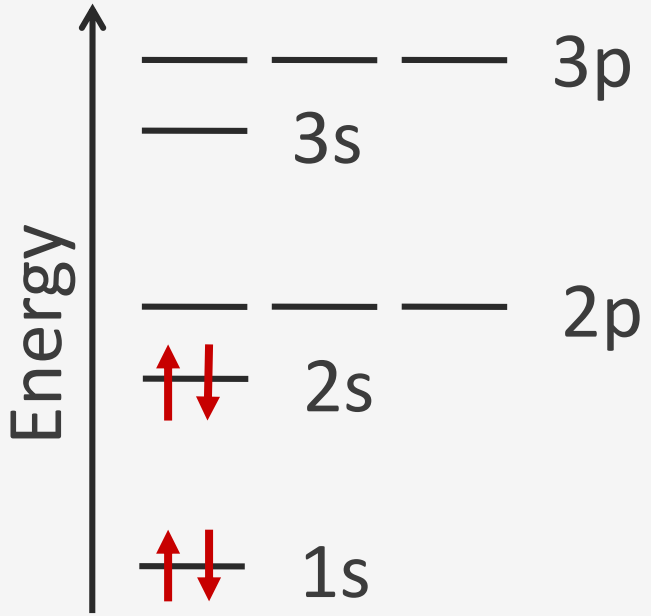


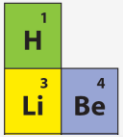




$$Li \rightarrow 1s^2 2s^1$$

How strong are electrons bonded



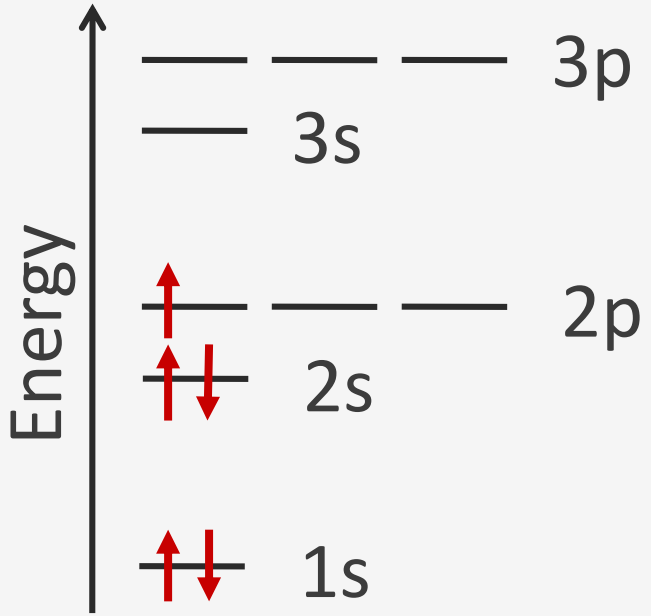


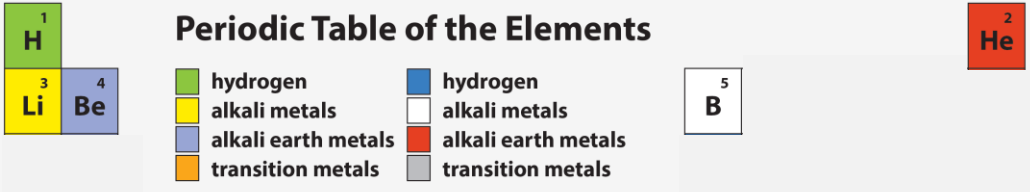
Periodic Table of the Elements

hydrogen	hydrogen
alkali metals	alkali metals
alkali earth metals	alkali earth metals
transition metals	transition metals

$$Be \rightarrow 1s^2 2s^2$$

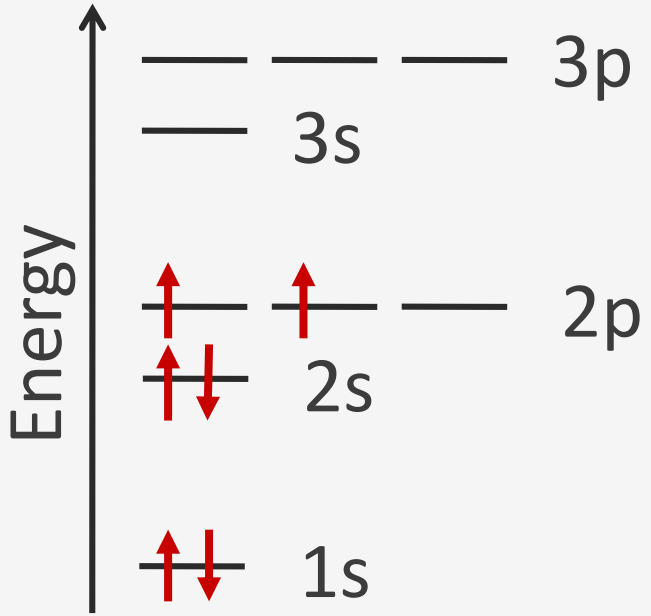
How strong are electrons bonded

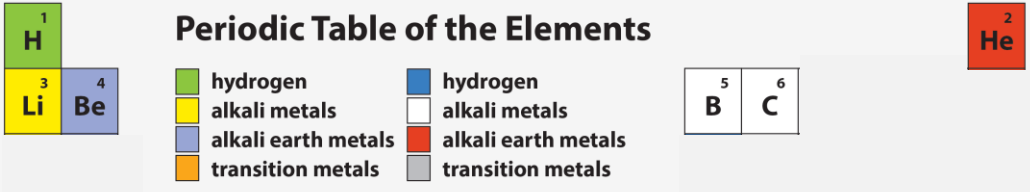




$$B \rightarrow 1s^2 2s^2 2p^1$$

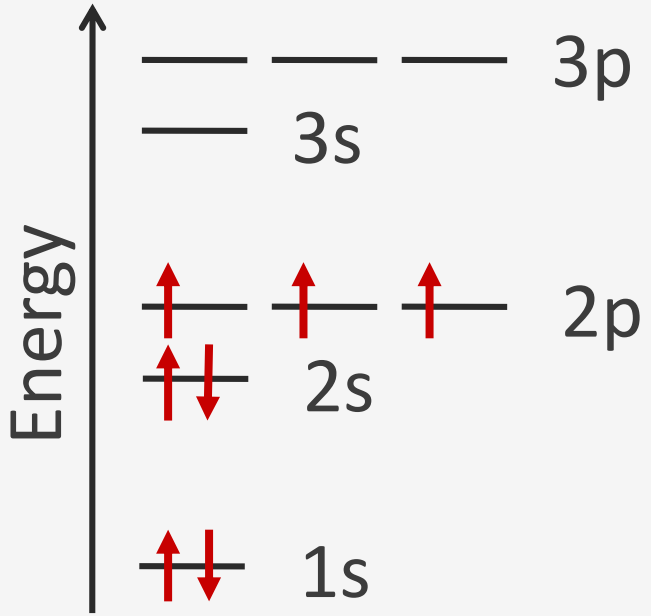
How strong are electrons bonded

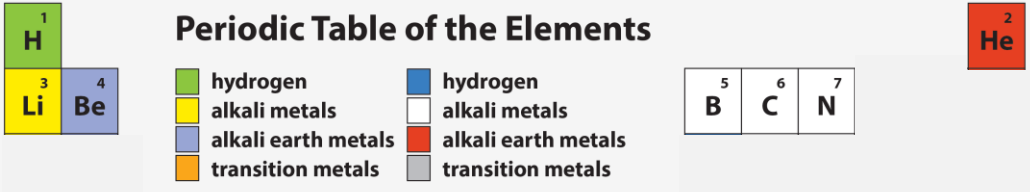




$$C \rightarrow 1s^2 2s^2 2p^2$$

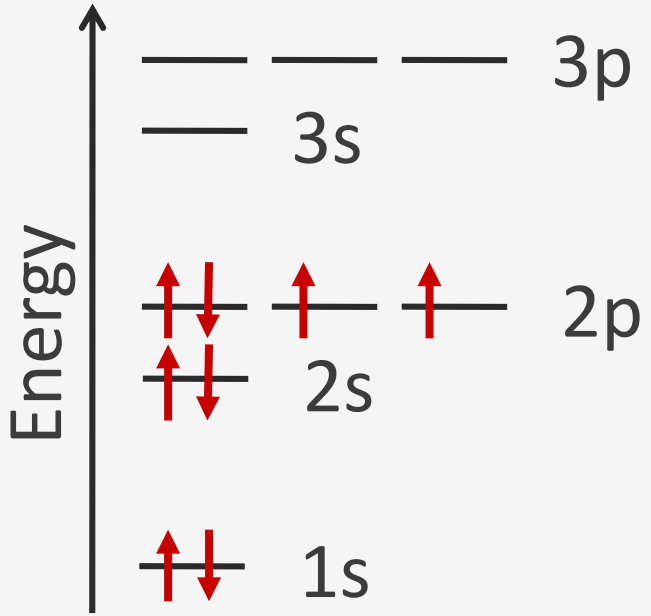
How strong are electrons bonded

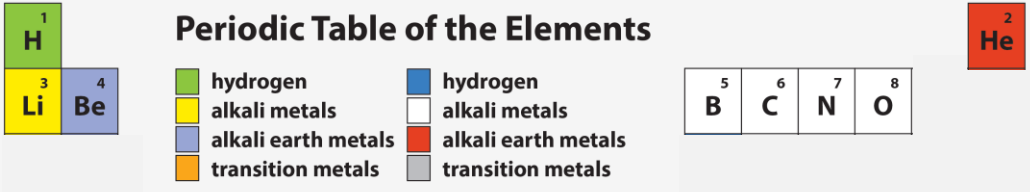




$$N \rightarrow 1s^2 2s^2 2p^3$$

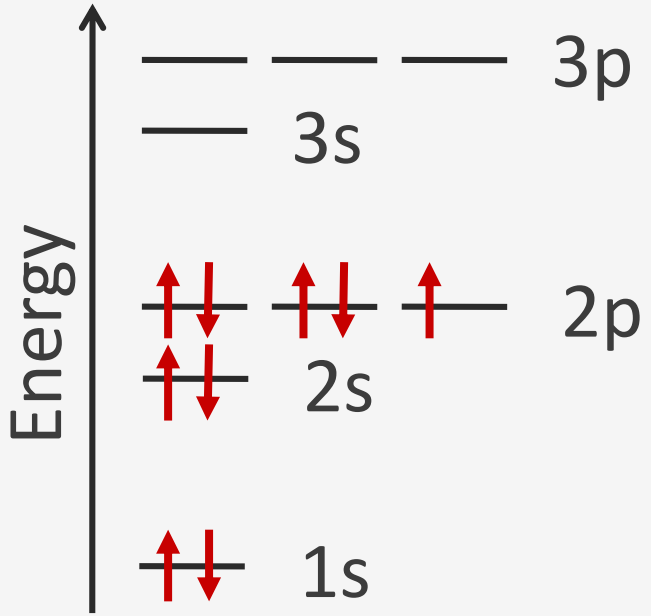
How strong are electrons bonded

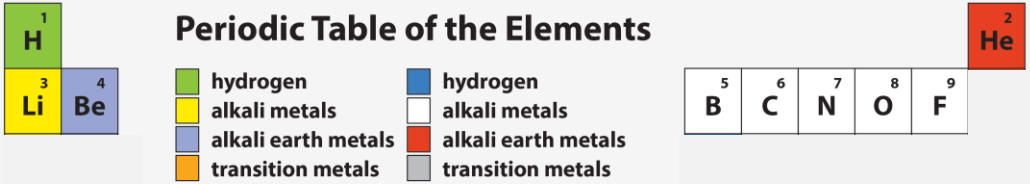




$$B \rightarrow 1s^2 2s^2 2p^4$$

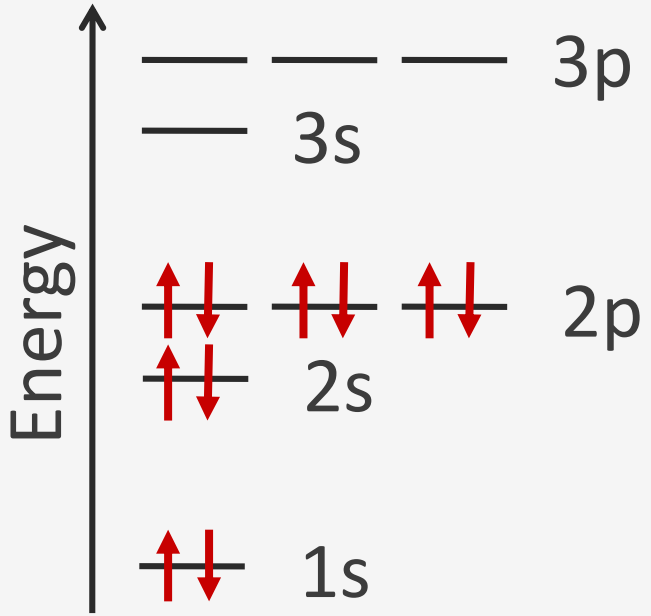
How strong are electrons bonded

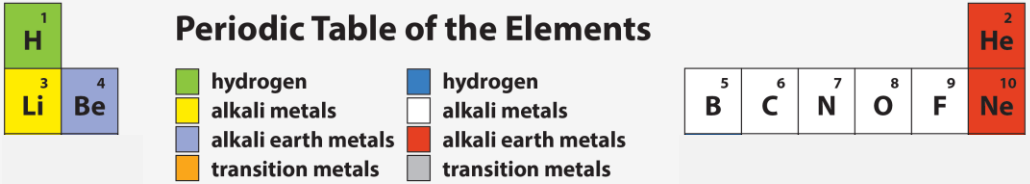




$$B \rightarrow 1s^2 2s^2 2p^5$$

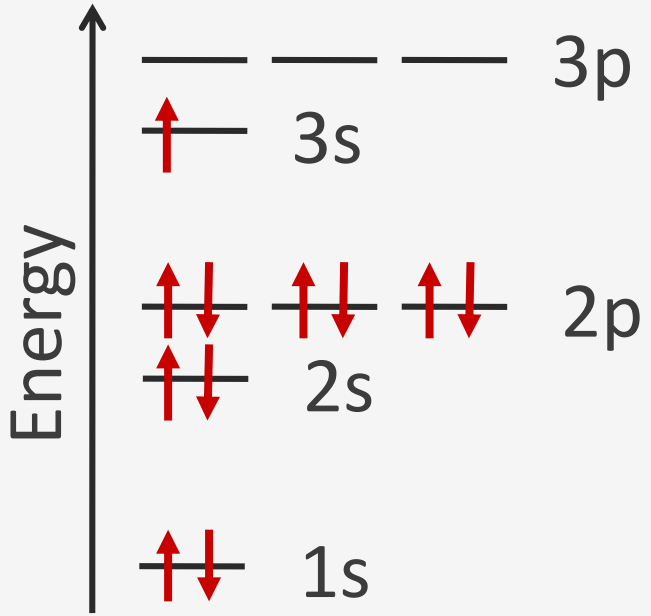
How strong are electrons bonded

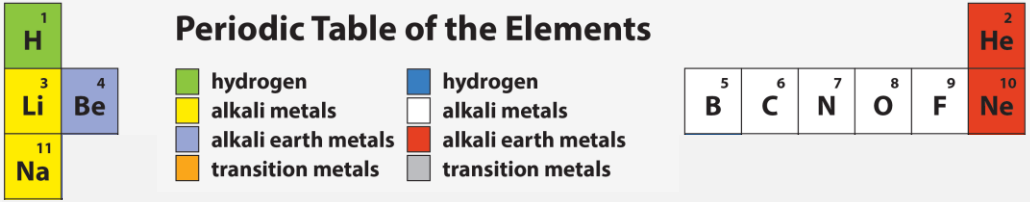




$$Ne \rightarrow 1s^2 2s^2 2p^6$$

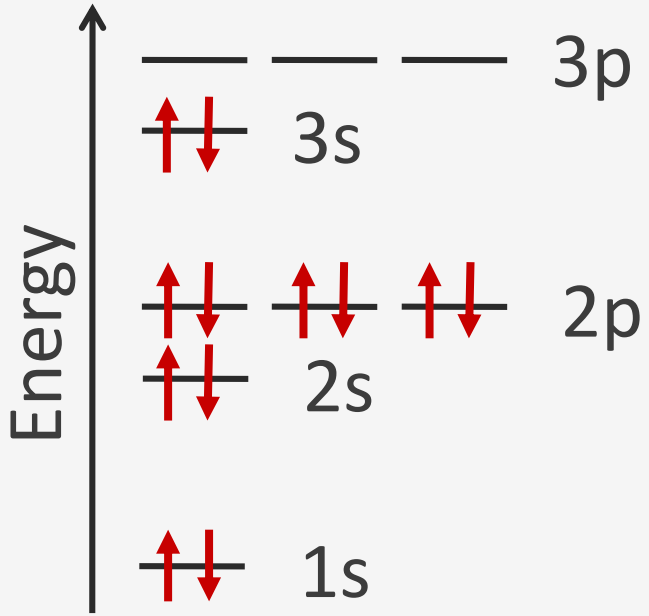
How strong are electrons bonded

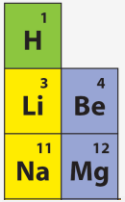




$$Na \rightarrow 1s^2 2s^2 2p^6 3s^1$$

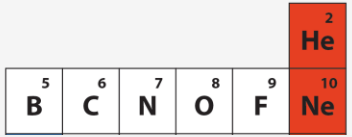
How strong are electrons bonded





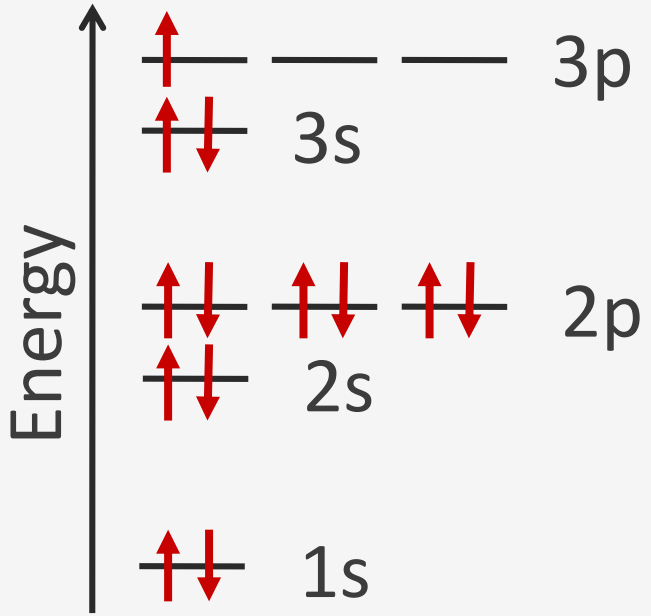
Periodic Table of the Elements

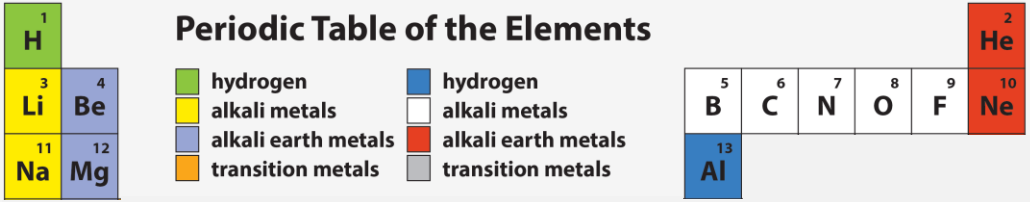
hydrogen	hydrogen
alkali metals	alkali metals
alkali earth metals	alkali earth metals
transition metals	transition metals



$$Mg \rightarrow 1s^2 2s^2 2p^6 3s^2$$

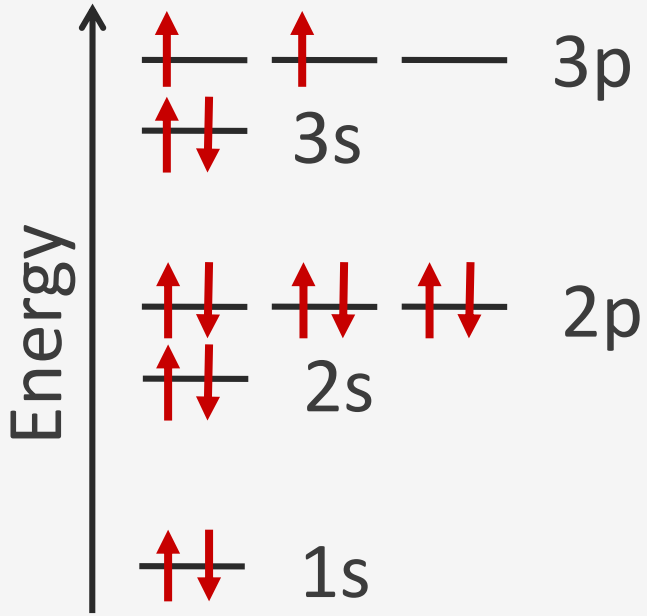
How strong are electrons bonded

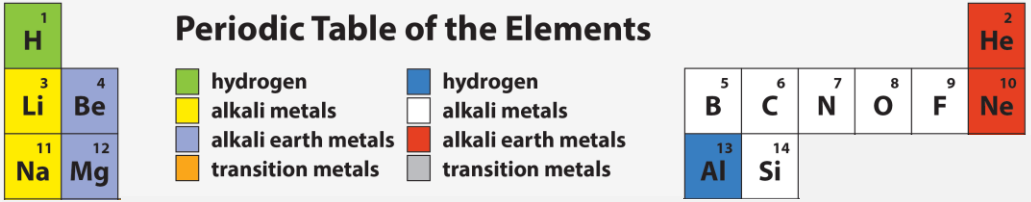




$$Al \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^1$$

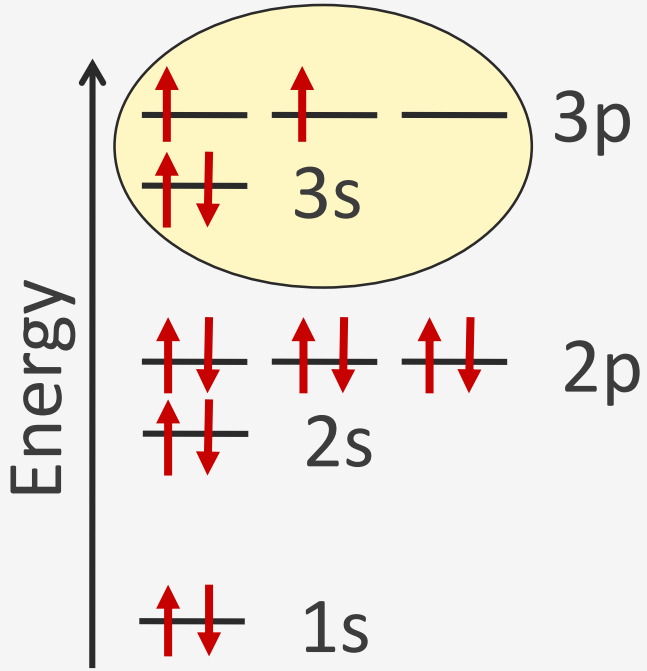
How strong are electrons bonded: the Si atom





$$Si \rightarrow 1s^2 2s^2 2p^6 3s^2 3p^2$$

Bonding of electrons in Si network



						VIIIA
		IIIA	IVA	VA	VIA	VIIA	2 He 4.0026
		5 B 10.811	6 C 12.011	7 N 14.007	8 O 15.999	9 F 18.998	10 Ne 20.180
IB	IIB	13 Al 26.982	14 Si 28.086	15 P 30.974	16 S 32.065	17 Cl 35.453	18 Ar 39.948
29 Cu 63.546	30 Zn 65.38	31 Ga 69.723	32 Ge 72.64	33 As 74.922	34 Se 78.96	35 Br 79.904	36 Kr 83.798
47 Ag 107.87	48 Cd 112.41	49 In 114.82	50 Sn 118.71	51 Sb 121.76	52 Te 127.60	53 I 126.90	54 Xe 131.29
79 Au 196.97	80 Hg 200.59	81 Tl 204.38	82 Pb 207.2	83 Bi 208.98	84 Po [209]	85 At [210]	86 Rn [222]

Si atom: 14 electrons

Bonding of electrons in Si network