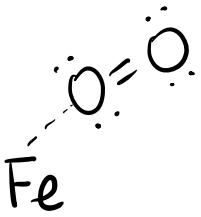
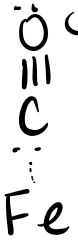
Why is CO poisonous, but not O_2?

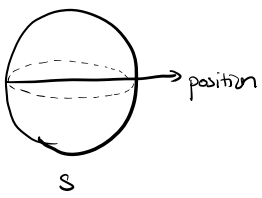
1. Interactions between Fe and CO/O_2
   → Molecular Orbital Theory

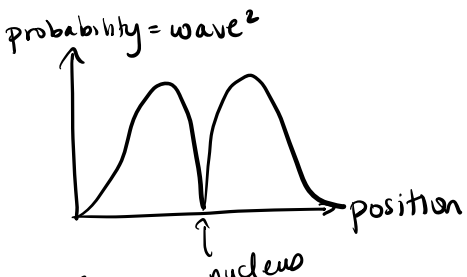
2. Structure of Hemoglobin

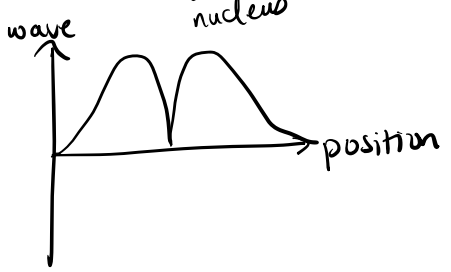


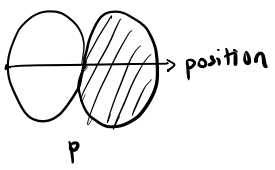


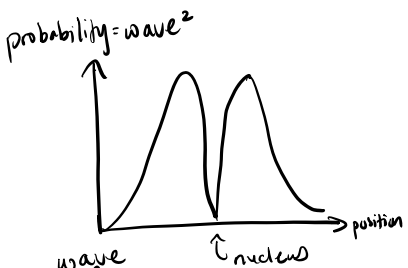
Atomic Orbitals - where an electron can be

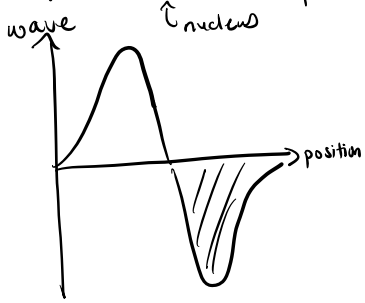








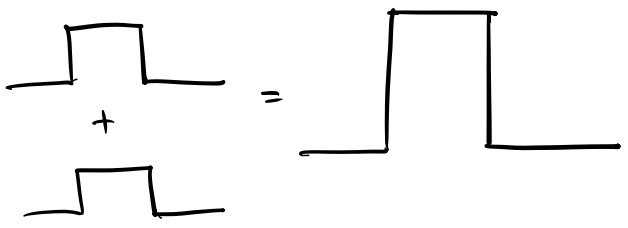


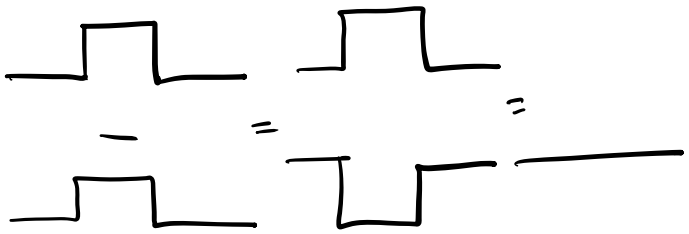


- we can describe probability of electron's position
- electrons can be described with waves

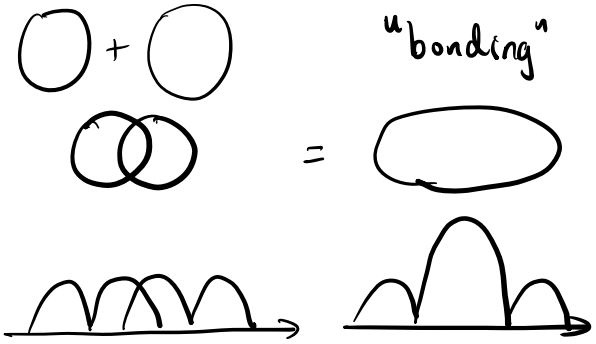
We can add and subtract orbitals like waves.

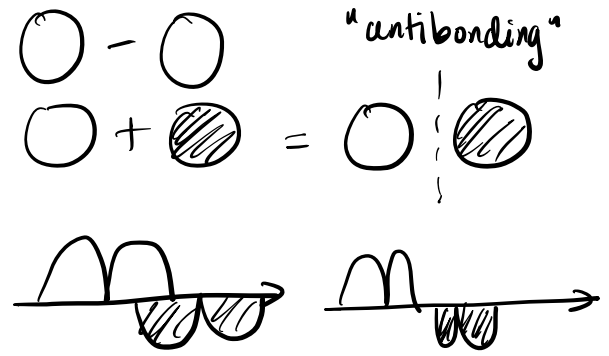
Waves

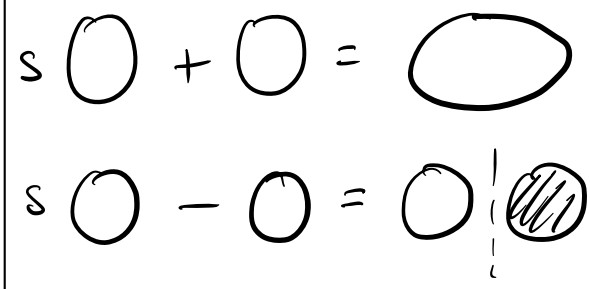


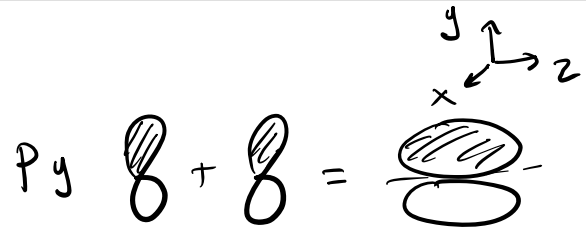


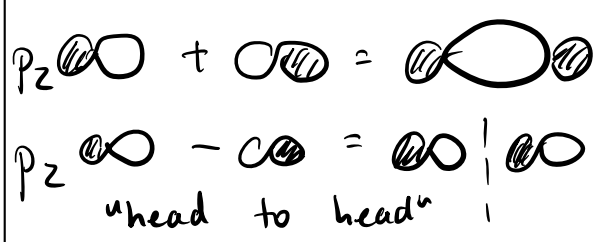
Orbitals

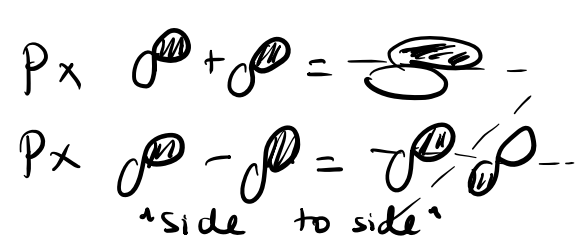








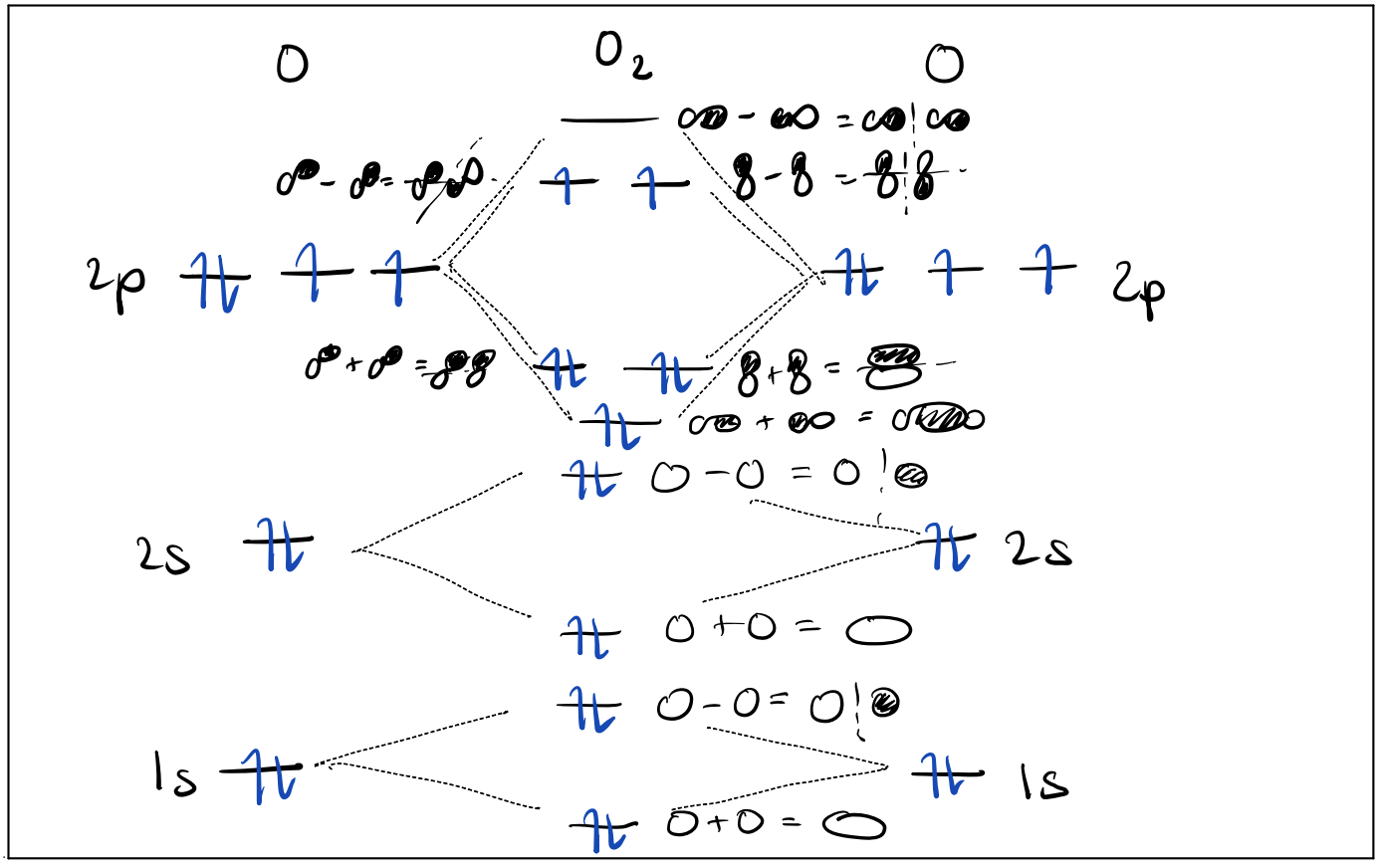




Orbital interaction depends on <u>shape</u> and <u>energy</u>

Molecular Orbitals of O_2

- bonding orbitals are more stabilized → lower energy
- "head to head" interactions stronger than "side to side"
- electrons are filled from bottom up



- Molecular orbitals interact with Fe in hemoglobin!
- Molecular orbitals for CO look different due to different energy levels of atomic orbitals. (O is more electronegative so the atomic orbitals are lower in energy)
- Only one orbital of O_2 binds to Fe, while two orbitals of CO bind to Fe.