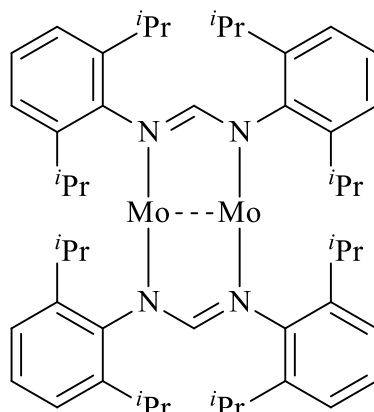


- In 2009, great excitement was generated amongst chemists worldwide with the report of a neutral Mo complex containing two bridging, anionic *N*-donor ligands. The structure of the complex is shown below. <sup>*i*</sup>Pr = isopropyl =  $-\text{CH}(\text{CH}_3)_2$

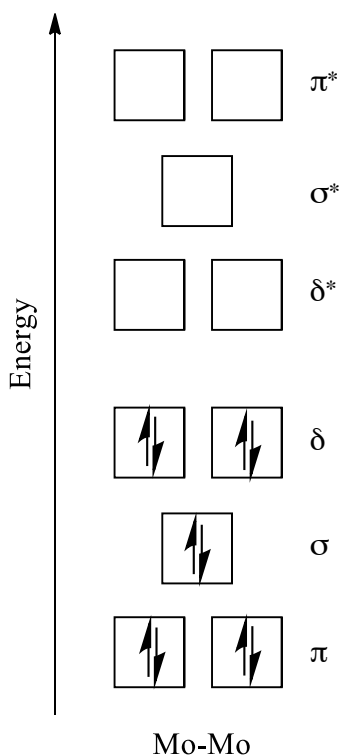


Name the complex by using standard IUPAC nomenclature. For simplicity, the name of the *N*-donor ligand (in its neutral form) can be shortened to “aminidate”.

**bis(aminidato)dimolybdenum(I)**

The Mo complex above possesses an extremely short Mo–Mo bond (202 pm), much shorter than the bonding distance between Mo atoms in Mo metal (273 pm)!

- Propose a reasonable explanation for the very short Mo–Mo bond length in the complex by adding *d*-electrons into the (*partial*) MO scheme shown below.
- Determine the bond order for the metal-metal bond and re-draw the structure of the complex shown above indicating the actual bonding between the two Mo atoms.



**(b) Molybdenum is present as Mo(I):  $4d^5$ . The 2 Mo(I) contribute 10 electrons to the Mo-Mo bonding orbitals. This fills the bonding levels shown opposite:**

$$\begin{aligned} \text{bond order} &= \frac{1}{2} (\text{number of bonding electrons} - \\ &\quad \text{number of antibonding electrons}) \\ &= \frac{1}{2} (10 - 0) = 5 \end{aligned}$$

**There is a quintuple bond between the metal ions:**

