KTT 111 : Inorganic Chemistry 1 : Model Answers

Sem 1 : 2004/2005 : Q5a & Q5b & 5c : CHEMICAL BONDING

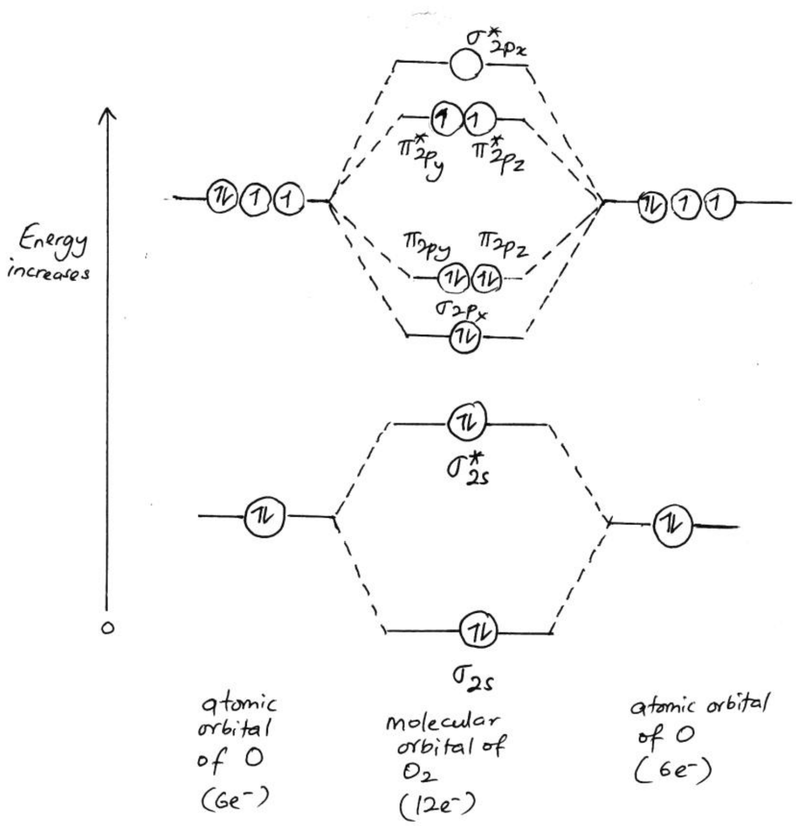
Sem1 : 2004/2005: Q5a

Sem 1 (2004/05): Molecular Orbital, MO Theory

Q5(a) O_2 molecule - paramagnetic properties

$O_2 : (\sigma_{1s})^2(\sigma^*_{1s})^2(\sigma_{2s})^2(\sigma^*_{2s})^2(\sigma_{2p_x})^2(\pi_{2p_y})^2(\pi_{2p_z})^2(\pi^*_{2p_x})^1(\pi^*_{2p_z}$

or



- two unpaired electrons
- Therefore O_2 has paramagnet properties.

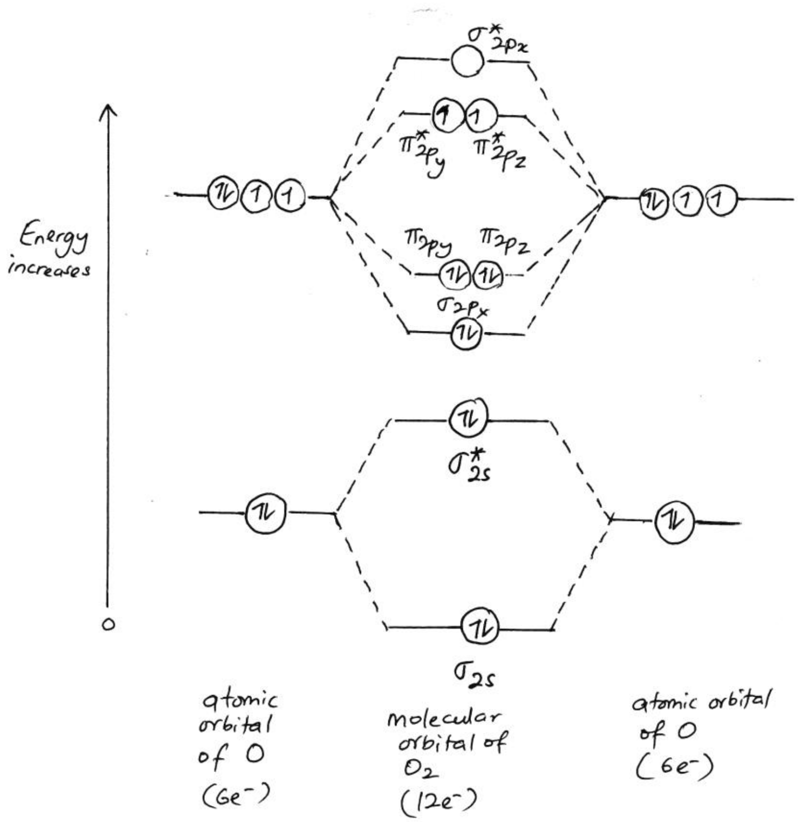
Sem 1 (2004/2005) 5b

Sem 1 (2004/05): Molecular Orbital, MO Theory

Q5 (a) O_2 molecule - paramagnetic properties

$$O_2 : (\sigma_{1s})^2(\sigma^*_{1s})^2(\sigma_{2s})^2(\sigma^*_{2s})^2(\sigma_{2p_x})^2(\pi_{2p_y})^2(\pi_{2p_z})^2(\pi^*_{2p_x})^1(\pi^*_{2p_z})^1$$

or



- two unpaired electrons
- Therefore O_2 has paramagnet properties.

Sem 1 : 2004/2005 : Q5c

Sem 1 (2004/05): Molecular Orbital, MO Theory

Q5(c): highest bond energy. N 2.⑤ O 2.⑥ } 11e⁻

NO : $[KK(\sigma_{2s})^2(\sigma^*_{2s})^2(\pi_{2p_y})^2(\pi_{2p_z})^2(\sigma_{2p_x})^2(\pi^*_{2p_y})^1]$

Bond order = $\frac{(\text{no. of bonding } e^- - \text{no. of antibonding } e^-)}{2}$

$= \frac{8-3}{2} = 2.5$

NO^- ($12e^-$ valence electron)

$[KK(\sigma_{2s})^2(\sigma^*_{2s})^2(\pi_{2p_y})^2(\pi_{2p_z})^2(\sigma_{2p_x})^2(\pi^*_{2p_y})^1(\pi^*_{2p_z})^1]$

Bond order $= \frac{8-4}{2} = 2.0$

Since bond order for NO is larger than the B.O of NO^-, so the bond energy of NO > bond. energy of NO^-. (Ans,

N = 2⑤
F = 2⑦

NF ($12e^-$: valence electron)

$[KK(\sigma_{2s})^2(\sigma^*_{2s})^2(\pi_{2p_y})^2(\pi_{2p_z})^2(\sigma_{2p_x})^2(\pi^*_{2p_y})^1(\pi^*_{2p_z})^1]$

Bond order $= \frac{8-4}{2} = 2.0$

B.O of NO > B.O of NF

∴ Bond energy of NO > Bond energy of NF (Ans)

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