

MW 5

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- 1) a) (a: $1s^{\uparrow} 2s^{\uparrow} 2p^6 3s^{\uparrow} 3p^6 4s^{\uparrow}$
 b) (c: $1s^{\uparrow} 2s^{\uparrow} 2p^{\uparrow}$)

- 2) a) (a: $L=0$ (symmetric ~~position~~)
 $S=0$ (antisymmetric spin $\rightarrow S=1$ forbidden by Pauli)
 $1s^{\uparrow} 2s^{\uparrow} 2p^6 3s^{\uparrow} 3p^6 4s^{\uparrow} \boxed{1S}$

- b) (c: $S=0$ (antisymmetric spin)
 Symmetric position $\rightarrow L=1 \pm 1 = 0, 2 \Rightarrow \boxed{1D, 1S}$
 $S=1$ (symmetric spin)
 Anti-sym. position $\rightarrow L=1 \pm 0 = 1 \Rightarrow \boxed{3P}$

- 3) a) (a: $J=L+S=0+0 \rightarrow \boxed{1S_0}$

$1s^{\uparrow} 2s^{\uparrow} 2p^6 3s^{\uparrow} 3p^6 4s^{\uparrow} 1S_0$ is the only state for (a) ground state configuration

- b) (c: $1S \rightarrow L=S=0 \rightarrow J=0 \rightarrow \boxed{1S_0}$
 $1D \rightarrow L=2, S=0 \rightarrow J=2 \rightarrow \boxed{1D_2}$
 $3P \rightarrow L=1, S=1 \rightarrow J=0, 1, 2 \rightarrow \boxed{3P_0, 3P_1, 3P_2}$

Note: these are all "ground states", although their energies can differ - you need to have included all of these angular-momentum states in your solutions.

EC: From 2b

Lowest energy is $3P$ ~~lowest~~ (Anti-sym. position)

Highest is $1S$ (sym. position with lowest $L \rightarrow$ the two e^- are very close)