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Quiz 36 ANSWERS

1.

p^2 and p^4:	$^1S_0$, $^1D_2$, ^3P
p^3:	^4S, ^2P, ^2D

A. What is the lowest L–S–J state from the $2s^22p^3$ configuration?

$2s^22p^3$ has ^4S, ^2P, ^2D terms. The lowest energy L–S–J term is $^4S_{3/2}$, so L = 0, S = 3/2, J = 3/2.

B. What is the lowest L–S–J state from the $2s2p^4$ configuration?

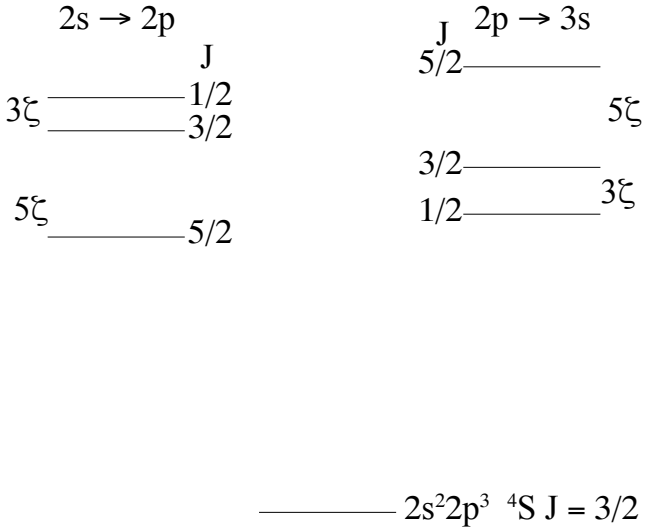
$2s\,2p^4$ has $2s\otimes[^1D, ^3P, ^1S] = ^2D, ^2P, ^4P, ^2S$.
^4P is the lowest but 2p subshell is more than 1/2 full.
$^4P_{5/2}$ is lowest, so L = 1, S = 3/2, J = 5/2.

C. What is the lowest L–S–J state from the $2s^22p^2$ configuration?

$2s^22p^23s$ has ^2D, ^2P, ^4P, ^2S. $^4P_{1/2}$ is lowest.

D. The ground state of the N atom belongs to the $2s^22p^33s$ configuration. There are allowed ($\Delta\ell = \pm1$) transitions from the ground state to L–S–J states belonging to the $2s2p^4$ and $2s^22p^23s$ configurations. How will the observable transitions enable you to recognize and distinguish the $2s \rightarrow 2p$; and $2p \rightarrow 3s$ transitions? Assume that you are able to uniquely determine the J–values of the upper states (by M_J–counting or g_J–measurements).

The ground state of N is $^4S_{3/2}$. The 2s→2p and 2p→3s excitations will yield exclusively a ^4P state. One is regular ($2s^22p^23s$) and the other is inverted ($2s2p^4$). The only transitions allowed are $\Delta S = 0$, $\Delta\ell = \pm1$. The energy level diagram will yield configurational assignments



The interval rule permits definitive assignments $\Delta J = +1, 0, -1$.

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