
PROBLEM SET 3

Oct. 12 Colloquium: “Investigating Investigating Galaxy Formation in the Early Universe with Quasar Absorption Line Systems”

Jason Prochaska, Carnegie Observatories

3:30 pm, 101 Rowland Hall

1. Eisberg and Resnick: 7.4
2. Identify the atoms that have the following ground state electronic configurations in their outer shell or shells: (a) $3s^2 3p^6 3d^8 4s^2$, (b) $4s^2 4p^4$ (c) $4s^2 4p^6 4d^2 5s^2$ (d) $4s^2 4p^6 4d^1 5s^2$, (e) $4s^2 4p^6 4d^{10} 4f^3 5s^2 5p^6 6s^2$.
3. Show that the multiplicity of a level, defined as the number of different J -values that can be formed from given L and S values, is $2L + 1$ or $2S + 1$, whichever is smaller.
4. What are the values of L , S , and J and the multiplicities of the levels having the following term designations: 1S_0 , 3D_2 , $^4P_{5/2}$, $^2F_{7/2}$, $^6I_{13/2}$?
5. What types of terms can result from the following values of L and S ? (Answer in spectroscopic notation.) (a) $L = 1$, $S = 1/2$ (b) $L = 3$, $S = 1$, (c) $L = 2$, $S = 7/2$, (d) $L = 5$, $S = 3/2$. (Partial answer: (a) $^2P_{1/2}$, $^2P_{3/2}$).
6. What spectral terms result from an electron configuration $3d 4f$, assuming LS coupling?
7. In the transition $^4F_{3/2} - ^{10}D_{5/2}$, how many lines will appear in the Zeeman pattern? Explain your reasoning by listing the allowed transitions.