Atomic and molecular physics
first written exam

October 27, 2017

1. The electron configuration of an excited state of carbon atom is $1s^2 2s^2 2p^1 3p^1$. For this configuration, determine all the possible atomic term symbols and order them by increasing energy.

2. Calculate the value of $J_{1s,2s}$ Coulomb integral.
Hints:

$$1s = \Psi_{100} = 2Z^{\frac{3}{2}} e^{-Zr} \frac{1}{\sqrt{4\pi}}$$

$$2s = \Psi_{200} = \frac{1}{\sqrt{8}} Z^{\frac{3}{2}} (2 - Zr)\, e^{-Zr} \frac{1}{\sqrt{4\pi}}$$

$$\int_0^\infty x^n e^{-ax} dx = \frac{n!}{a^{n+1}} \qquad (n = 0, 1, 2, \ldots; a > 0)$$