231B: Quantum Review

Quiz 2
(Dated: January 26, 2020)

1. What is $[L_\mathrm{x}, L_\mathrm{z}]$?

2. What is the eigenvalue of L^2 of $Y_1^1(\theta, \phi)$?

3. Repeat 2 for L_z.

4. What is the transition frequency between the first and second excited states in Li^{2+}?

5. Knowing $E_0 = -\frac{z^2}{2}$ for the hydrogenic atom, deduce V_0, the expectation value of potential energy.

6. What is $\langle l, m|L_\mathrm{y}|l, m-1\rangle$?

7. The usual sequence of angular orbitals is s, p, d, and f. If the next set is g orbitals, what is the lowest principle quantum number which has them?

8. Find $\langle 1|x|2\rangle$ for a harmonic oscillator.

9. If $\hat{H} = \hat{T} + \lambda\hat{V}$, and $\langle\lambda\hat{V}\rangle = 2\lambda^2$, what is E?

10. For a particle on a ring of radius 2, what is the degeneracy of the 3rd excited state?