

ASSIGNMENT-2 (DEADLINE 7 PM ON 7/9/2020)

- ① WHAT ARE SPHERICAL HARMONICS? DISCUSS THE PROPERTIES OF THE SPHERICAL HARMONICS.

WRITE ABOUT AN APPLICATION OF THE SPHERICAL HARMONICS (EXCLUDING QUANTUM HYDROGEN ATOM MODEL AND THE ROTATION OF A QUANTUM PARTICLE ON A SPHERE) IN NATURAL SCIENCES.

- ② CONFIRM THAT THE SPHERICAL HARMONICS
(a) $Y_{0,0}(\theta, \phi)$, (b) $Y_{2,-1}(\theta, \phi)$, and (c) $Y_{3,+3}(\theta, \phi)$

SATISFY THE ~~SCHRODINGER~~ SCHRODINGER EQUATION FOR A PARTICLE FREE TO ROTATE IN THREE DIMENSIONS, AND FIND ITS ENERGY AND ANGULAR MOMENTUM IN EACH CASE.

- ③ CONFIRM THAT $Y_{3,+3}(\theta, \phi)$ IS NORMALIZED TO 1 (THE INTEGRATION REQUIRED IS OVER THE SURFACE OF A SPHERE.)

- ④ ~~EVALUATE~~ EVALUATE $\int_0^\pi \int_0^{2\pi} Y_{3,2}^*(\theta, \phi) Y_{3,-2}(\theta, \phi) \sin \theta d\theta d\phi$
(YOU NEED TO SUBSTITUTE THE CORRESPONDING Y FUNCTIONS AND SOLVE THE INTEGRAL)

- ⑤ SOLVE THE FOLLOWING TRIPLE INTEGRALS.

(a) $\int_0^\pi \int_0^{2\pi} Y_{2,0}^*(\theta, \phi) Y_{1,0}(\theta, \phi) Y_{3,0}(\theta, \phi) \sin \theta d\theta d\phi$

(b) $\int_0^\pi \int_0^{2\pi} Y_{2,0}^*(\theta, \phi) Y_{1,0}(\theta, \phi) Y_{-2,0}(\theta, \phi) \sin \theta d\theta d\phi$