Consider the state of a particle of mass μ confined to a unit sphere (a rigid rotor)

$$|\psi_1\rangle = -\frac{1}{\sqrt{2}}|2,1\rangle + \frac{1}{\sqrt{2}}|2,-1\rangle$$

Whenever appropriate, state explicitly the quantum postulate(s) that justify your predictions and calculations for each question.

1. If you measure the z-component of the angular momentum, what are the possible values you could obtain with nonzero probability? What are the probabilities for these measurements?
2. If you measure the square of the angular momentum, what are the possible values you could obtain with nonzero probability? What are the probabilities for these measurements?
3. If you measure the energy, what are the possible values you could obtain with nonzero probability? What are the probabilities for these measurements?
4. Calculate the expectation values of the observables for $\hat{L}_z$, $\hat{L}^2$, and $\hat{H}$.
5. What is the wavefunction for the same particle at an arbitrary time t?
6. How will your answers to the questions 2-5 change with time?

Repeat all of the questions above for the state:

$$|\psi_2\rangle = \frac{\sqrt{3}}{2}e^{\frac{i\pi}{3}}|2,1\rangle + \frac{1}{2}|3,1\rangle$$