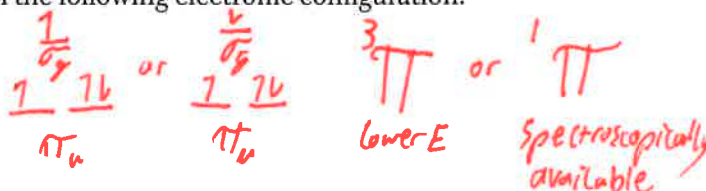
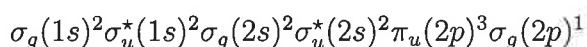


Quiz 11.4 - Electronic Spectroscopy

Name: Key

Electronic Term Symbols

Give the term symbol for the excited state of C_2 with the following electronic configuration:

List all selection rules for electronic transitions

$$\Delta L = 0, \pm 1 \quad \Delta S = 0$$

$$\Delta \Sigma = 0$$

$$\Delta \Omega = 0, \pm 1$$

 $\Sigma \leftrightarrow \Sigma$ must preserve \pm symmetry

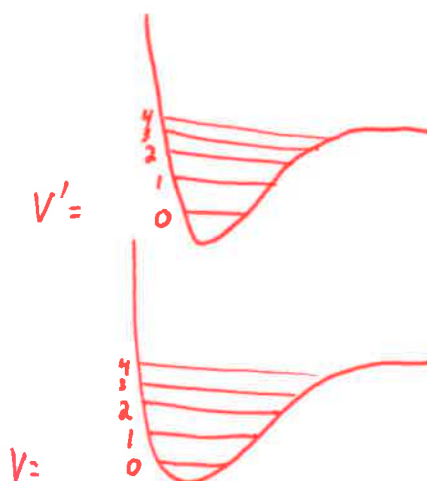
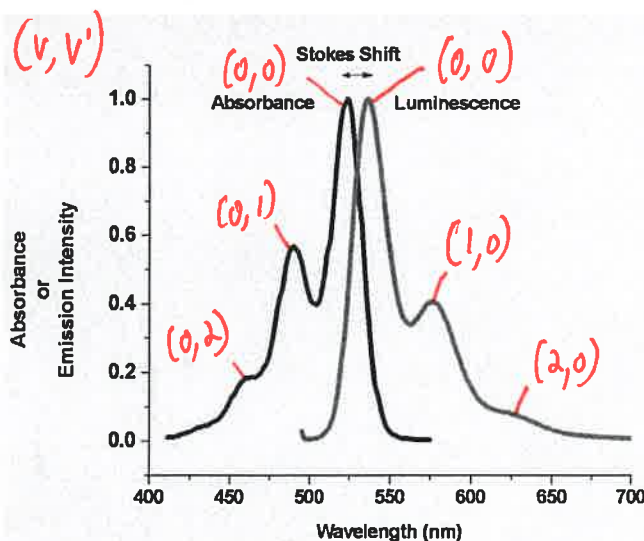
g/u symmetry must switch

Franck Condon Factors

An electronic excitation significantly weakens and lengthens a chemical bond. Which vibrational state of the excited electronic state is likely to show the strongest transition? (Generally, I'm not looking for a particular value of v')

excited vibrational state ($v' > 0$)

The absorption and fluorescence spectra below show a few vibronic transitions. Give each peak a label indicating the initial and final vibrational states involved in each transition. Vibrational states of the ground electronic state should be referenced by their v quantum number, and vibrational states of the excited electronic state should be referenced by their v' quantum number



(Little to no change in bond-length)

Next to the spectrum above, roughly sketch the potential wells and vibrational states for the electronic states involved.

Decay Pathways

Classify each decay pathway as *internal conversion*, *fluorescence*, *phosphorescence*, or *inter-system crossing*

- $S_1 \rightarrow T_1$ (radiationless) *I.S.C.*
- $S_1 \rightarrow S_0$ (radiative) *fluorescence*
- $S_1 \rightarrow S_0$ (radiationless) *I.C.*
- $T_1 \rightarrow S_0$ (radiative) *phosphorescence*
- $T_1, v' = 6 \rightarrow T_1, v' = 0$ (radiationless) *I.C. (or vibrational relaxation)*