

## Theorievragen Keuzevak luminescentie spectroscopie

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### 1) Fluorescence/phosphorescence

1a) An organic compound in solution can decay from the electronically excited state through the emission of fluorescence and/or phosphorescence. Describe these two processes, using a Jabloski diagram.

1b) Describe which processes can be in competition with the fluorescence (at least 3), and give a formula for the fluorescence quantum yield.

1c) Phosphorescence is a relatively rare phenomenon, Give two reasons why organic compounds in solution usually do not show phosphorescence under regular conditions.

### 2) Broadening processes in fluorescence

Explain in your own words which factors or broadening processes contribute to the linewidth of electronic transitions in an organic compound in the following cases: (disregard instrumental factors)

- a Single molecule in a low-temperature frozen matrix
- b Ensemble of molecules in a frozen crystalline (Shpol'skii) matrix at low T
- c Ensemble of molecules in a frozen amorphous matrix at low T
- d Ensemble of molecules in a liquid solution at room T
- e Ensemble of molecules in the gas phase at room T

Also: give an estimate of the typical width of an electronic transition in such systems

### 3) LC-fluorescence

Suppose we want to build a liquid chromatography-fluorescence setup that (instead of only measuring fluorescence intensities) can record fluorescence emission spectra of the separated chromatographic peaks. A laser is used for excitation; fluorescence emission from the flow cell is collected with a lens and focussed on the entrance slit of a monochromator.

3a) In order to record spectra, the monochromator can be scanned (using a single photomultiplier) or can be set to a certain wavelength (using a CCD camera). Which setup would you rather use? Give at least two reasons.

3b) Explain what the advantages and disadvantages would be of measuring fluorescence spectra instead of only measuring fluorescence intensities.