$A = \varepsilon b C = -\log T$

$T = \frac{P}{P_0}$ $\quad E = \frac{hc}{\lambda} = h\nu$

$F = 2.303 P_0 \Phi \varepsilon b C$

$h = 6.62 \times 10^{-34}$ J-s

$c = 3.00 \times 10^{8}$ m/s

Name Answer Key

Quiz 6 (10 pts)
CEM 434
Fall 2016

1 (3 pts). What is the wavelength (nm) and frequency of a photon with an energy of 3.81×10^{-19} J? In what part of the EMS does the photon belong?.

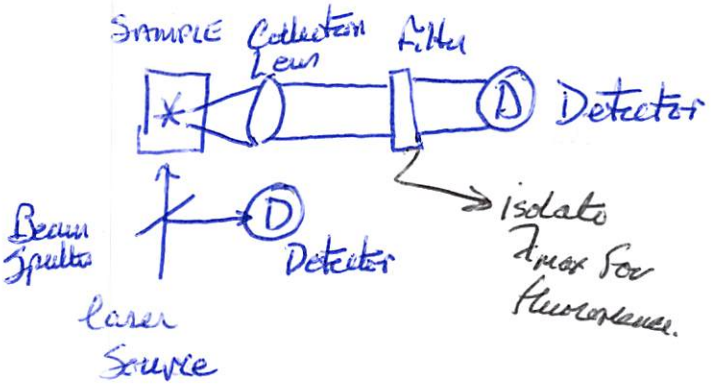
$E = \frac{hc}{\lambda}$ $\quad \lambda = \frac{hc}{E} = \frac{(6.62 \times 10^{-34}\ \text{J-s})(3.00 \times 10^{8}\ \text{m/s})}{3.81 \times 10^{-19}\ \text{J}} = 5.21 \times 10^{-7}\ \text{m}$

$= 521\ \text{nm}$

$E = h\nu$ $\quad \nu = \frac{E}{h} = \frac{3.81 \times 10^{-19}\ \text{J}}{6.62 \times 10^{-34}\ \text{J-s}} = 5.76 \times 10^{14}\ \text{s}^{-1}$

Visible region of Spectrum

2 (3 pts). Sketch the design of a laser-induced fluorescence instrument. Why are lower detection limits possible with LIF as compared to a traditional scanning instrument?



(1) Fewer optical components so more light reaches detector.

(2) High power of laser leads to greater fluorescence intensity

$F \propto P_0$

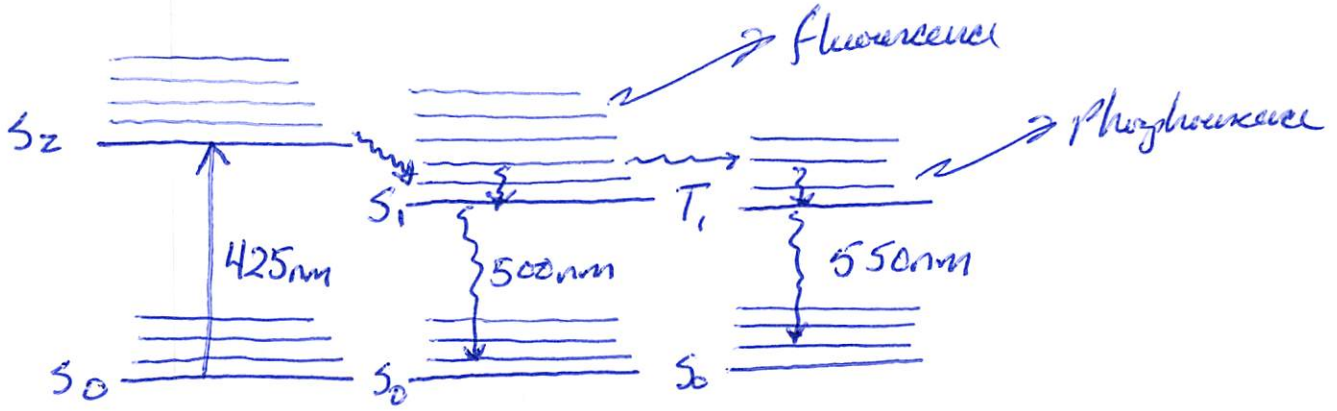
3 (2 pts). Describe two ways in which the quantum efficiency for a fluorophore can be increased. What is the mechanism?

1) Lower temperature of Solution (less collisional deactivation)

2) Greater solution viscosity

P/P_0	%T	A
1	100	0
0.1	10	1
0.01	1	2

4. (2 pts) A molecule phosphoresces with a single peak at 550 nm. The single fluorescence peak is at 500 nm. The absorption peak is at 425 nm. Based on this information, roughly sketch the Jablonski diagram labeling transitions and calculating differences in each energy state in nm.



$S_0 \rightarrow S_2 = 425\,nm$

$S_1 \rightarrow S_0 = 500nm$

$T_1 \rightarrow S_0 = 550nm$

$\Delta\lambda = E_{exc} - E_{emis}^{FL} = 425 - 500\,nm = |75nm|$

$\Delta\lambda = E_{exc} - E_{emis}^{Phos} = 425 - 550nm = |125nm|$

$\Delta E = \frac{hc}{\Delta\lambda}$ Could calculate in energy units.