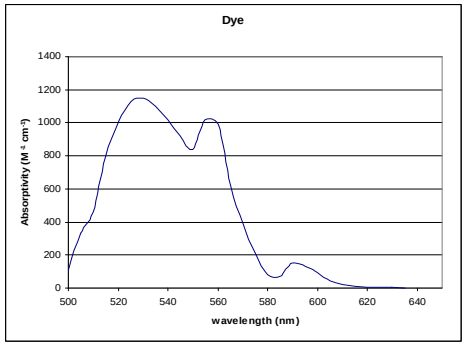
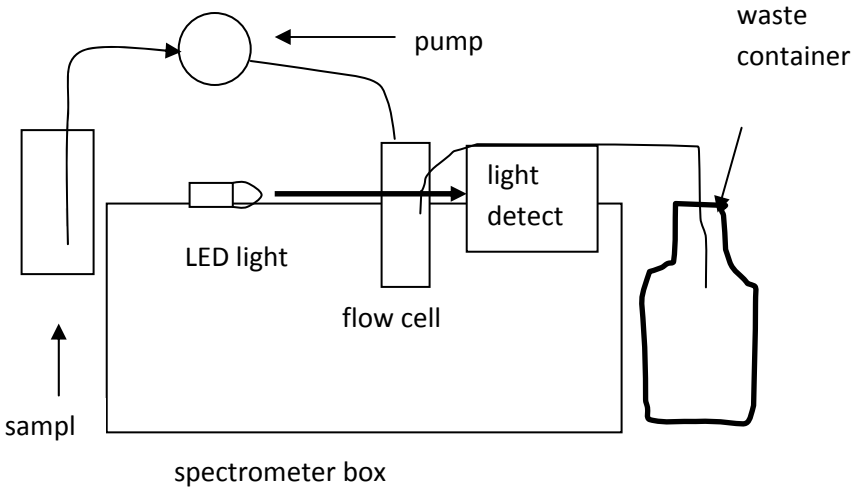
CHEMISTRY 133

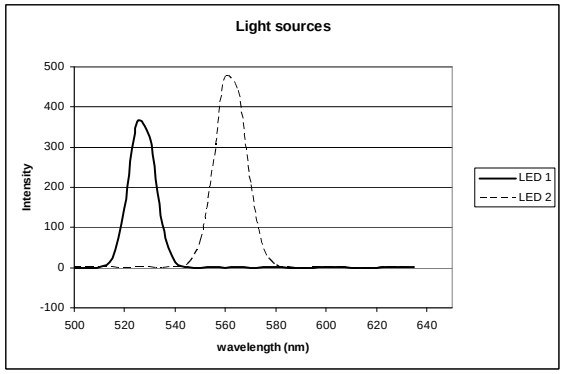
Name_____ **Quiz 4 – 10 points**

1. A simple absorption spectrometer is shown in the diagram below to measure the concentration of a dye added to sodas. The dye spectrum and LED spectral responses are also given. The dye concentrations are expected to range from 0.30 to 1.00 mM and the cell path is 0.40 cm.

$E = h\nu = hc/\lambda$ where $h = 6.626 \times 10^{-34}$ Js and $c = 3.00 \times 10^{8}$ m/s







a) What is the energy of a typical photon originating from LED 2 (dashed line)?

λ = 560 nm or $E = hc/\lambda = (6.63 \times 10^{-34}$ Js)(3.00 x 10^{8} m/s)/(560 x 10^{-9} m) = ***3.55×10^{-19} J***

b) Which LED should be selected (LED 1 or LED 2)? Consider possible deviations to Beer's law and whether typical A values are in a good range in explaining your answer.

LED 1 is better because LED 2 produces light where $\Delta\varepsilon/\Delta\lambda$ is large while it is relatively small for LED2. For LED 1 (λ = 525 nm), $\varepsilon = 1100\ M^{-1}\ cm^{-1}$. $A = \varepsilon bC = (1100\ M^{-1}\ cm^{-1})*(0.4\ cm)*(3 \times 10^{-4}$ to $1 \times 10^{-3}\ M)$ = 0.13 to 0.44

For LED 2, $\varepsilon = 800\ M^{-1}\ cm^{-1}$. A = 0.09 to 0.32 (either is o.k. in terms of best A region – LED 1 slightly better)