HomeworkDue 20 Feb before class.NAMEPractice with Photometric Quantities (100pts).Please refer to the lecture on spectrophotometry.

Problems 3, 4, and-5) show your work! Show the substitutions in to the equations.

Put a box around your answers AND include units where appropriate.

1. 15pts) Convert the following absorbance values to % transmittance.

A	0	0.1	0.3	1	2	4	8
T (%)							

2. 15pts) Convert the following % transmittance values to absorbance.

T (%)	0	1	10	50	90	99	100
A							

3. 20pts) You have 3 identical glass plates. Each plate has a transmittance of 10%. What is percent transmittance of the stack of 3 plates?



4. 20pts) You have a dye solution in a cylindrical beaker. The absorbance of this solution for a light beam coming through the bottom of the beaker is 0.4. Now you dilute the dye solution by adding an equal volume of water to the beaker. All of the solution remains in the beaker (no dye has been removed). What is the absorbance now? Explain you answer.



5. 30pts) Let's compare the strength of the absorption of organic dyes and Au nanoparticles. Summarize you results in the table below.

A) The strongest absorbing dyes have peak absorptivities of $\sim 10^5 \text{ M}^{-1} \text{ cm}^{-1}$. Calculate C_{abs} in cm² for a dye with an absorptivity of $2 \times 10^5 \text{ M}^{-1} \text{ cm}^{-1}$.

B) A 20 nm diameter gold nanoparticle has C_{ext} of 4.3×10^{-12} cm² at its plasmon resonance. Calculate the absorptivity (M⁻¹cm⁻¹) of the gold nanoparticle. Here *mole* refers to *mole of nanoparticles* rather than a mole of gold atoms—the constituents of the nanoparticles.

C) Let's think about this comparison. Typical organic dye molecules have a molecular mass of $M \approx 600$ g/mole. Is this a meaningful comparison? (rhetorical) Assuming FCC packing, as we did in an earlier homework, what is the "molecular mass" M of 20 nm diameter Au nanoparticles? (The mass of a mole (6.02×10^{23}) of nanoparticles.)

D) Which is a stronger absorber on a per mass basis? Divide each absorptivity by the "molecular mass." Which is the stronger absorber on a per mass basis?

Summary table for problem 5.

	\mathcal{E} $(M^{-1}cm^{-1})$	$C_{\rm ext}$ (cm ²)	M (g/mole)	ϵ/M (M ⁻¹ cm ⁻¹ mole g ⁻¹)	check (x) the box of the stronger absorber
organic dye	2×10 ⁵		600		
Au nanoparticles		4.3×10^{-12}			