

website: <http://tinyurl.com/randaro>

click on Summer Chem 1M and 1N

username and password are

rarochem & boom

Office Hours: M & W 2-3 & by appointment

You must enroll into the correct section on WebAssign (the one in which you are enrolled)

Class Keys: Section A ucsc 4831 0439

Section B ucsc 0183 4873

Date	Exp. #	Title
7/31	---	Requirements, locker check-in, webassign; data worksheet
8/2	1	Density
8/7	2	Empirical Formula of MgO
8/9	4	Antacid Analysis by Back Titration
8/14	6	Hydrogen Emission Spectrum
8/16	9	Allura Red in Mouthwash
8/21	12	Reaction Rates
8/23	14	Vitamin C Analysis; Check-out

next Tuesday

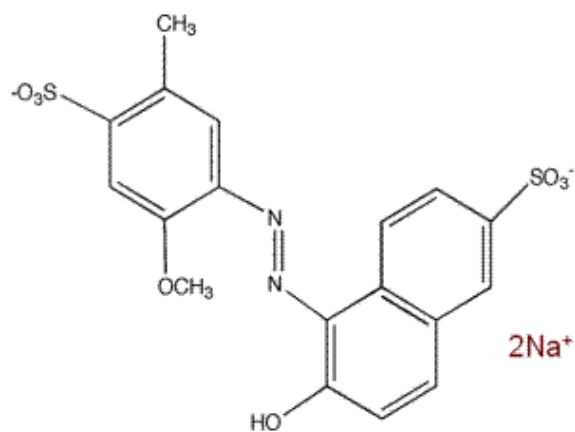
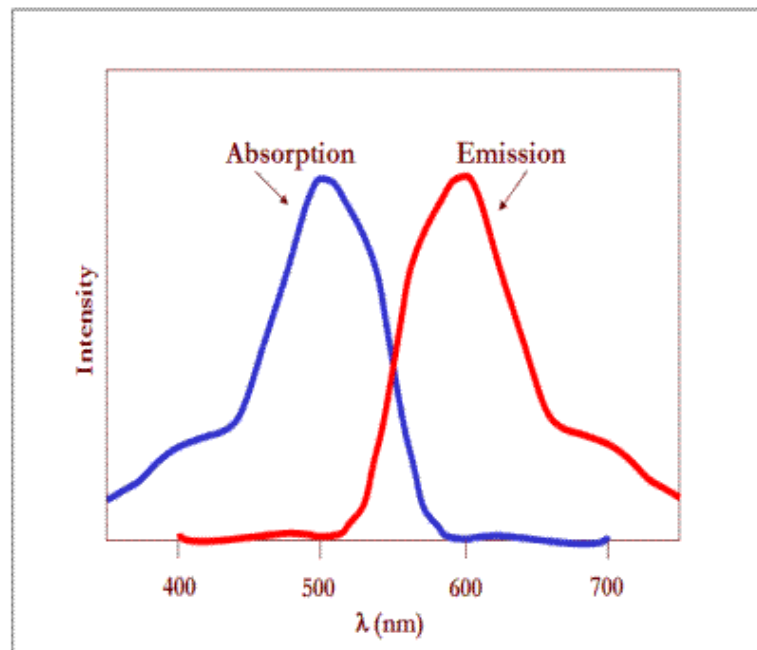
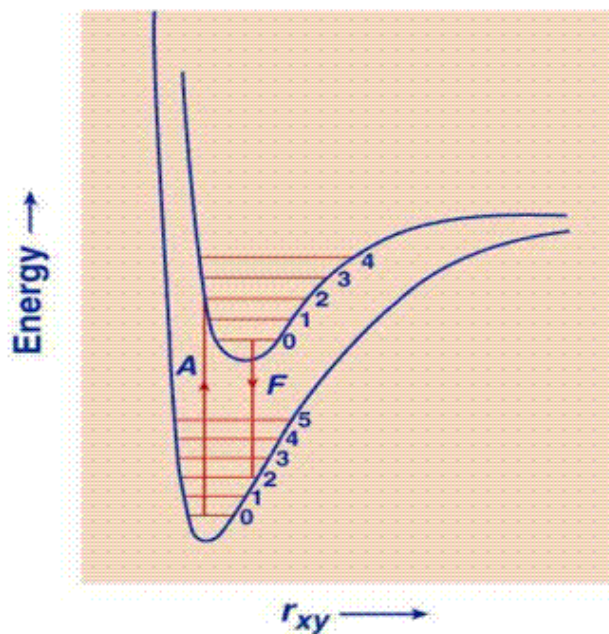
inlab & review lab 9

prelab & quiz lab 12

written procedural outline
& data tables lab 12

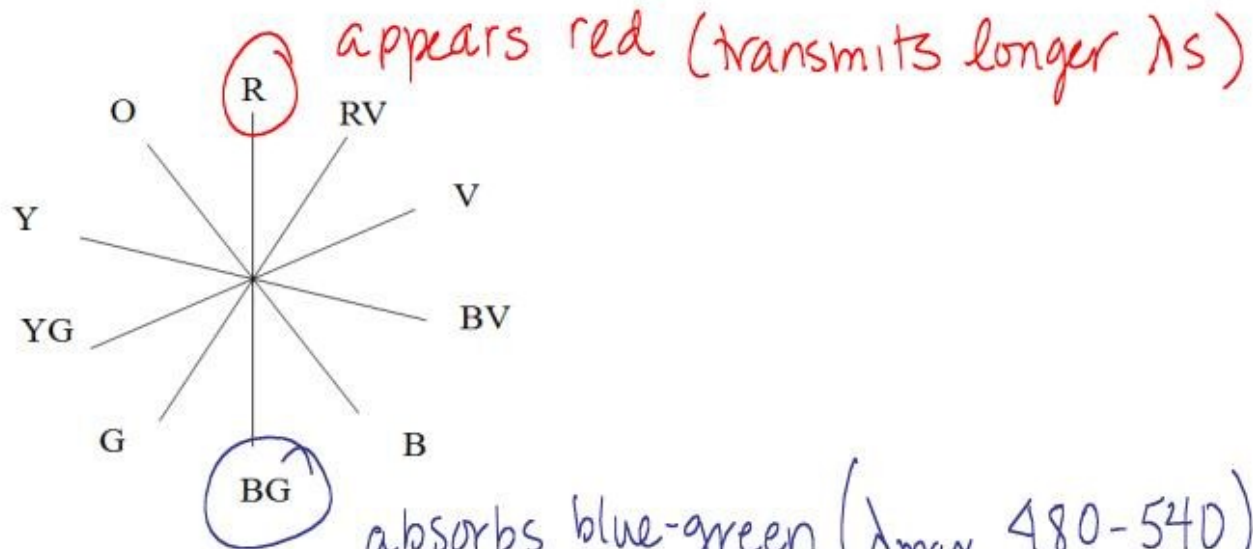
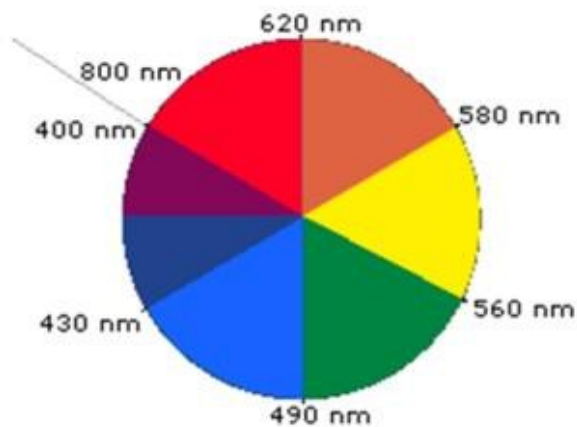
→ Just in case you need a bit more time on the inlab, I extended the due date to Monday morning @ 7 am.

Absorption of Light by Allura Red (Red Dye #40)



Formula: $C_{18}H_{14}N_2Na_2O_8S_2$

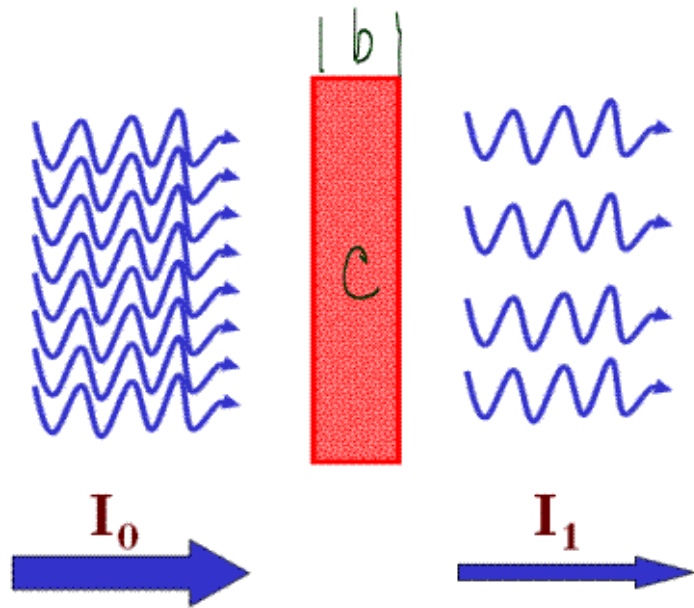
Molar mass: 496.42 g/mol



appears red (transmits longer λ s)

absorbs blue-green ($\lambda_{\max}$ 480-540)
literature value $\lambda_{\max} \sim 504$ nm





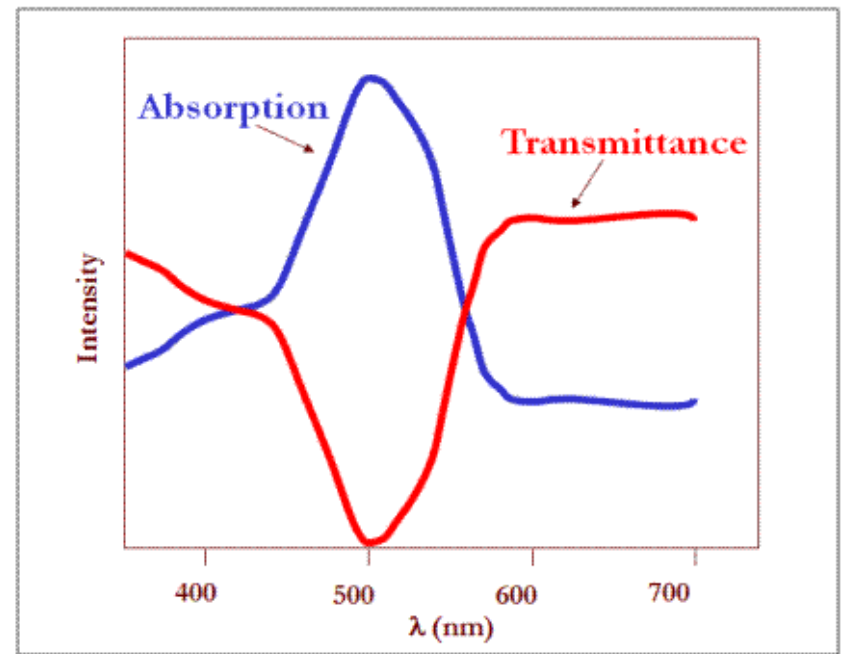
$$\% \text{ Transmittance} = \left(\frac{I_{\text{out}}}{I_{\text{in}}} \right)^{-\epsilon bc} \times 100\%$$

b = pathlength in cm

c = concentration in mol/L

ϵ = molar extinction coefficient in L/mol·cm

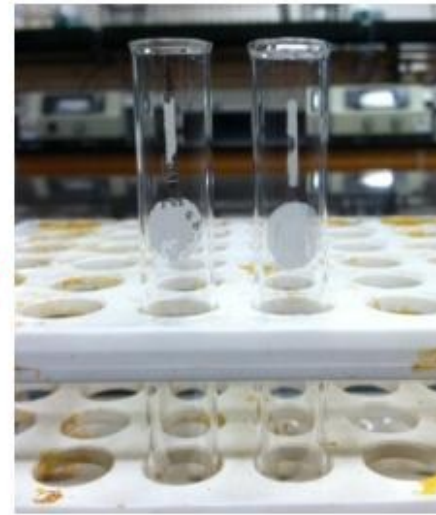
$$\text{Absorbance, } A = -\log \left(\frac{\%T}{100\%} \right) = \epsilon bc$$



both molecule &
wavelength specific



Read %T
&
convert to
A



on/off & 0% T
sample holder
empty w/
lid w/ lid closed
adjust the needle
to 0% T w/ knob



set 100% T
"blank" in sample
holder & close lid;
set needle to 100% T
w/ knob

blank is
deionized water

Part 1 Determine $\lambda_{\max}$ - Create a Spectral Profile

Use stock solution $4.0 \times 10^{-5} \text{ M}$

2 sig figs in concentrations

* You need about 40 mL stock solution for parts 1 & 2

blank in one cuvette, stock in the other

Blank @ every wavelength

Table 1

$\lambda (\text{nm})$

%T

$$A = -\log\left(\frac{\%T}{100}\right)$$

400 to 700

20 nm intervals

except between

480 - 540 nm

⇒ 10 nm intervals ⇐

one
decimal
place

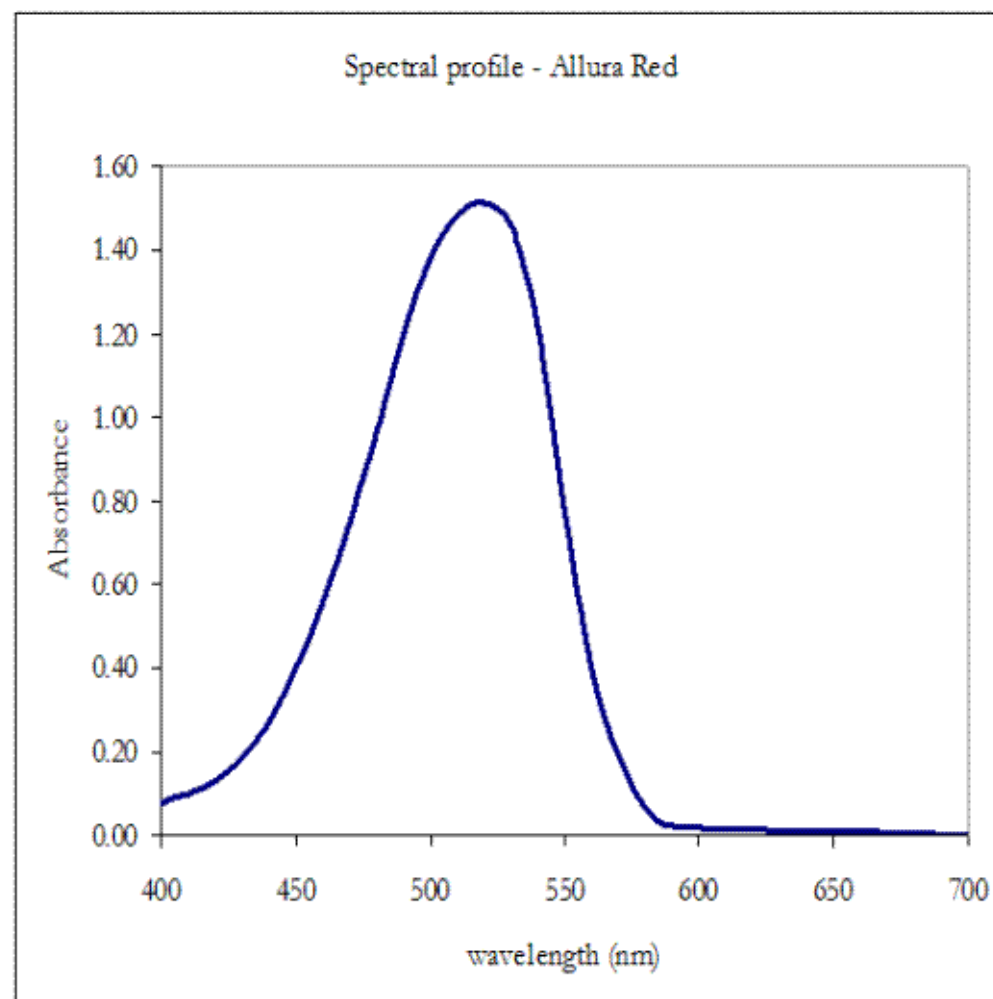
3 decimal
places

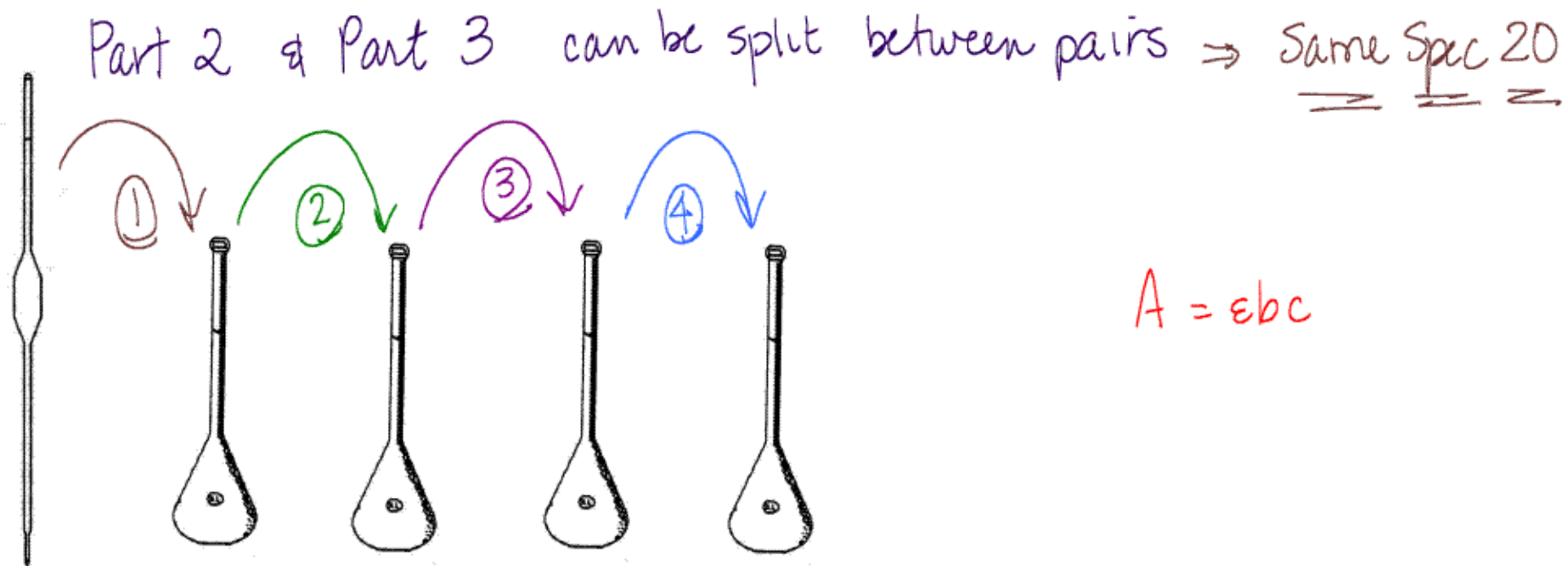
$\lambda_{\max}$ is wavelength of minimum %T $\equiv$ maximum Absorbance

Plot A vs λ = Spectral Profile

For Parts 2 & 3, set λ on Spec 20 to $\lambda_{\max}$ (480 - 540 nm)

λ (nm)	Absorbance
400	0.078
420	0.130
440	0.268
460	0.555
480	0.966
490	1.189
500	1.383
510	1.485
520	1.515
530	1.459
540	1.217
560	0.395
580	0.063
600	0.019
620	0.015
640	0.010
660	0.009
680	0.006
700	0.000





Part 2 Known Concentrations & measure %T & convert to A

Beer's Law Plot $A \propto \text{conc}$ (plot A vs c $\Rightarrow$ slope = ϵb)

Pipet 25.00 mL of $4.0 \times 10^{-5} \text{ M}$ into 50.00 mL volumetric flask & dilute to mark
 $\Rightarrow 2.0 \times 10^{-5} \text{ M}$ measure %T

Pipet 25.00 mL of $2.0 \times 10^{-5} \text{ M}$ into 50.00 mL flask & dilute
 $\Rightarrow 1.0 \times 10^{-5} \text{ M}$ measure %T

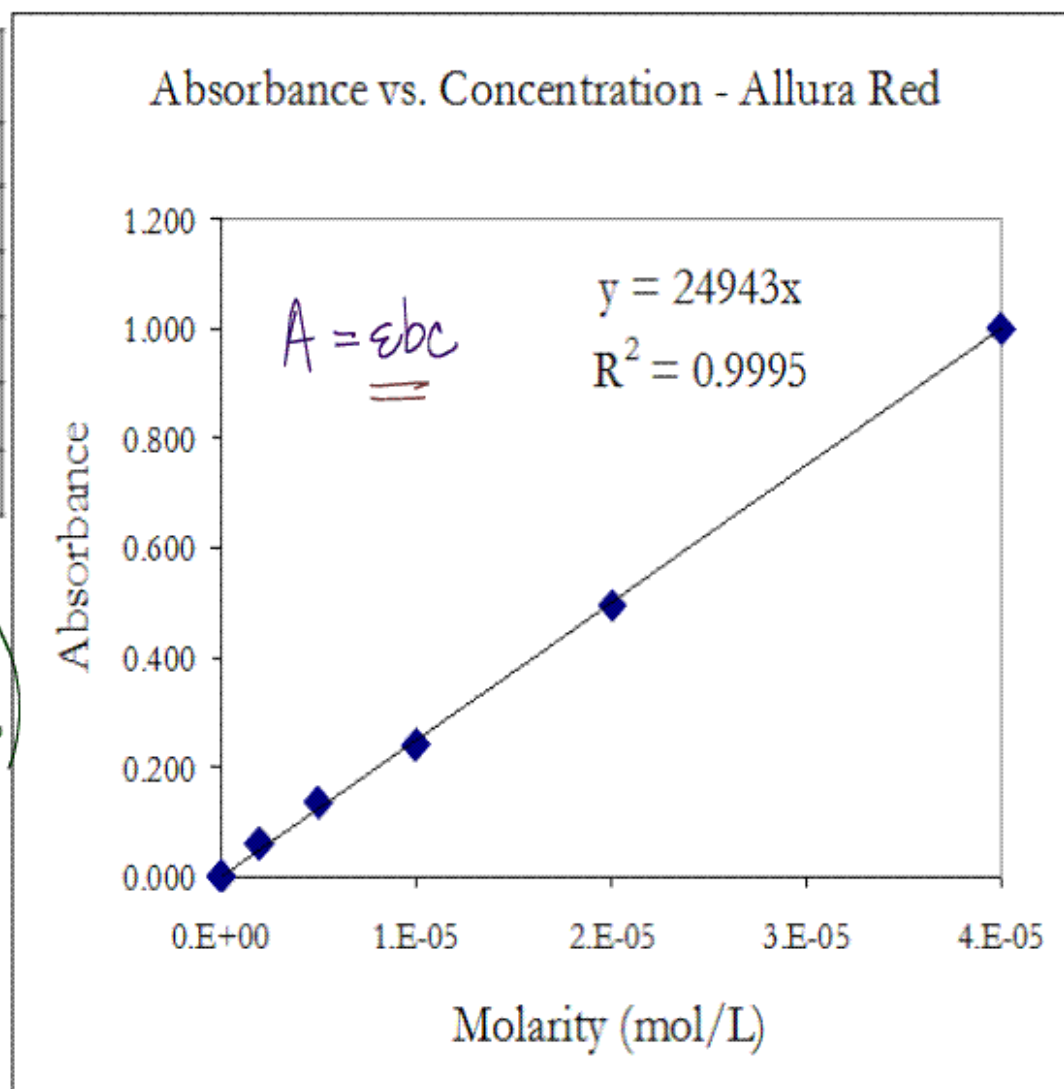
2 more times:

#3 $5.0 \times 10^{-6} \text{ M}$, #4 $2.5 \times 10^{-6} \text{ M}$

} 6 data points,
including blank & stock

Dilution Factor	M (mol/L)	T	A = -logT
0	0	1.00	0.000
1/16	2.E-06	0.87	0.060
1/8	5.E-06	0.73	0.137
1/4	1.E-05	0.58	0.240
1/2	2.E-05	0.32	0.495
1	4.E-05	0.10	1.000

Stock M $\nearrow$ 4E-05 $\nearrow$ mol/L $\nearrow$
 2 sig figs $\nearrow$ %T, not T $\nearrow$
 1 decimal place $\nearrow$
 $A = -\log\left(\frac{\%T}{100\%}\right)$
 3 decimal places



Plot A vs c

slope = ϵb 2 sig figs

$\epsilon = \frac{\text{slope}}{b}$ 2 sig figs

measure the inner diameter of cuvette to 2 decimal places

Part 3 Mouthwash Allura Red Concentration

Take ~ 7ml mouthwash & use 2.00ml diluted to 50.00ml for each trial

⇒ Make 3 separate dilutions ⇐

Table 3	%T	A	M_{dilute} (2 sig figs)	M_{conc}
1	1 dec	3 dec	$C_{\text{dilute}} \times \frac{A}{\text{slope}}$	$\times 25 = C_{\text{conc}}$
2	place	places		
3				

Table 4	M_{dilute} ($\mu\text{mol/L}$)	M_{conc}
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unrounded average & σ

rounded averages w/ σ to one sig fig & average to that decimal place

example $2.3 \times 10^{-5} \frac{\text{mol}}{\text{L}} = 23 \times 10^{-6} \frac{\text{mol}}{\text{L}} = 23 \mu\frac{\text{mol}}{\text{L}}$

AR molecules
mL use average values & 2 sig figs