Practice Questions

[**1**] The absorbance is a dimensionless quantity, that is, a quantity without units. What will be the units of $\in$, the specific absorptivity? Remember that 1 mL = 1 cm^3.
From Beer-Lambert law:
$A = \in lC$
A is the absorbance
$\in$ is the extinction coefficient
l is the cell path length
C is the concentration
The units of $\in$ are
$\in$ = [A] / [cm X C] → $\in$ = [$cm^{-1}(C)^{-1}$]
where C is the concentration units that you are using.

[**2**] How does the percent transmittance of a solution vary with (a) increasing concentration and (b) increasing path length?
2a
Percent Transmittance is inversely proportional to the concentration (more light goes through if the solution is very dilute).
2b
Percent Transmittance is inversely proportional to the Path length. Recall that $A = -\log[I/I_0]$, thus the relation between the these quantities is logarithmic.

[**3**] The absorbance of an iron thiocyanate solution containing 0.00500 mg Fe/mL was reported as 0.4900 at 540 nm.
[a] Calculate the specific absorptivity, including units, of iron thyocyanate on the assumption that a 1.00 cm cuvette was used.
[b] What will be the absorbance if (1) the solution is diluted to twice its original volume and (2) the solution is placed in a 5.00 cm cuvette?
3a
$\in$ = [A] / [cm X C]
$\in$ = [0.4900] / [1.00 cm X 0.00500 mg/mL] → $\in$ = [98.0 $cm^{-1}(mg/mL)^{-1}$]
3.b1
$A = \in lC$
A = [98.0 $cm^{-1}(mg/mL)^{-1}$] X 1.00 cm X [0.00250] → 0.2450
3.b2
$A = \in lC$
A = [98.0 $cm^{-1}(mg/mL)^{-1}$] X 5.00 cm X [0.00250] → A = 1.225

[**4**] Reffer to problem 3.
[a] What percent of light is transmitted by the original iron thiocyanate solution?
[b] What concentration of iron thiocyanate will absorb 50% of the entering light?
4a
$A = -\log[I/I_0]$
$-0.4900 = \log[I/I_0]$ → $0.3236 = [I/I_0]$
$[0.3236 \text{ X } I_0] = I$ → 32.36% of the light is transmitted
4b
50.0% → 0.500
-log [0.500] = A → 0.3010 = A = $\in lC$
0.3010 = [98.0 $cm^{-1}(mg/mL)^{-1}$] X 1.00 cm X [C]
C = 0.00307 mg/mL

[**5**] The concentration of yeast t-RNA in an aqueous solution is 10 μg/mL. The absorbance is found to be 0.209 when this solution is placed in a 1.00 cm cuvette and 258 nm radiation is passed through it.
[a] Calculate the specific absorptivity, including units, of yeast t-RNA.
[b] What will be the absorbance if the solution is diluted to 10 μg/mL?
[c] What will be the absorbance if the path length of the original solution is increased to 5.00 cm?
5a
$\in$ = [A] / [cm X C] → $\in$ = [0.209] / [1.00 cm X 10 μg/mL]
$\in$ = [0.209 $cm^{-1}(\mu g/mL)^{-1}$]
5b
$A = \in lC$
A = [0.209 $cm^{-1}(\mu g/mL)^{-1}$] X 1.00 cm X [5.00 μg/mL]
A = 0.01045
5c
A = $\in lC$ = [0.209 $cm^{-1}(\mu g/mL)^{-1}$] X 5.00 cm X [10.00 μg/mL] = 1.045

Practice Graph **Name:**_____

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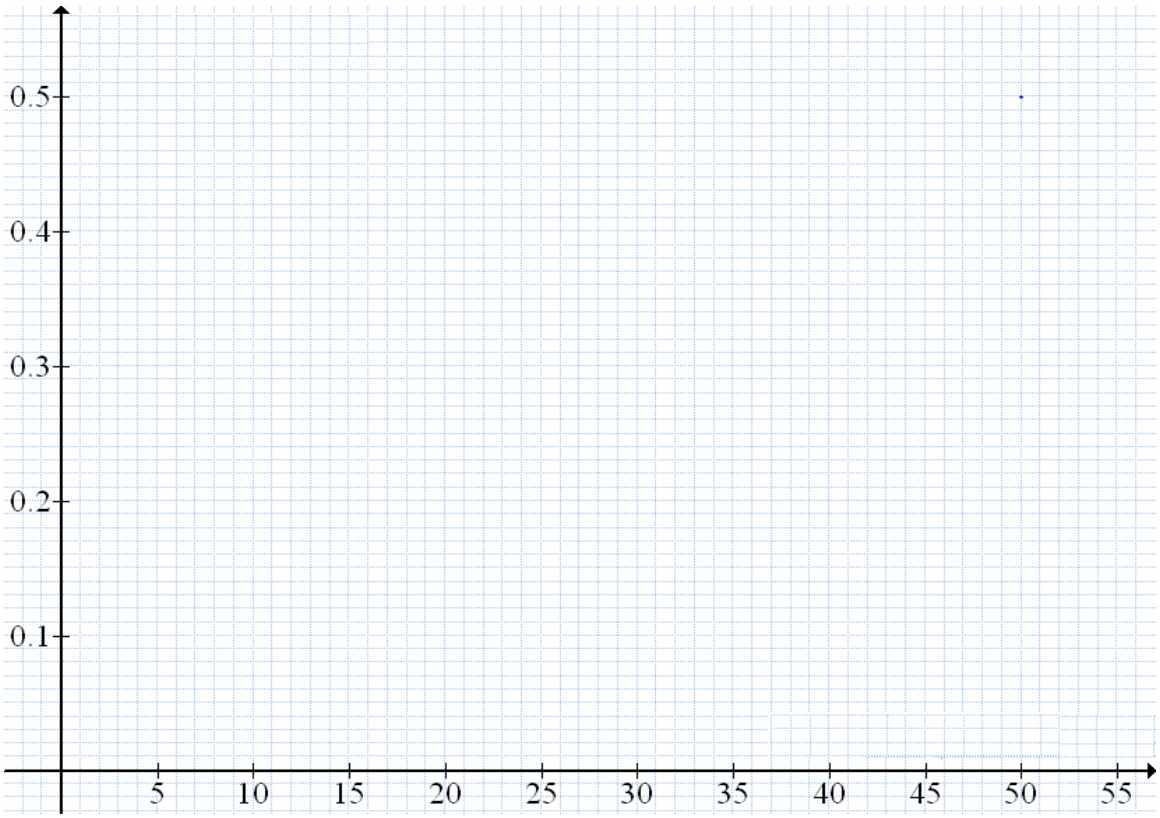
Use the Graphical Analysis program to plot Concentration in the X axis and Absorbance in the Y axis.

Conc (g/mL) X 10^{-5}	Absorbance
44.18	0.4134
35.42	0.3251
21.81	0.2027
8.79	0.0820
5.32	0.0491
3.51	0.0315



[**6**] A 2.845 g sample of an unknown compound containing cobalt(II) ion was dissolved in water in a 250 mL volumetric flask. The absorbance of this solution was found to be 0.2195 at 515 nm in a 1 cm cell.
[a] Use the graph to find the concentration of cobalt(II) ion in the solution.
[b] Calculate the percentage of cobalt in the unknown compound.