PRE-LAB EXERCISE

Question 1 (40 points)

Here you need to write one or two short paragraphs about the content of Experiment 3 in the manual. You need to talk about the following topics. Note that you should manage these materials to make your answer like an official introduction to this lab.

----Please briefly define the word "eutrophication" in the manual and state the cause of it.

----Please write the principle of spectrophotometric analysis. Since phosphate solution colorless, you need to give the coloring method.

----In your own words, summarize the basic way to construct a calibration curve.

----Please write the equation of Beer-Lambert Law and explain each parameter in the equation.

Eutrophication is the excessive nutrient input and will cause the gradual increase in the concentration of phosphorus, nitrogen, and other plant nutrients in an aging aquatic ecosystem such as a lake. The extensive use of fertilizers, the combustion of fossil fuels and waste from animal feedlots are main causes.

The analysis depends most on the absorption of light. An ammonium vanadomolybdate reagent can make phosphate solution has color thus making the amount of absorption easy to measure. The amount of absorption is linearly dependent to the solution's concentration.

By making a linear fit with A and c, according to Beer-Lambert law, We can find that the slope is εb and intercept is 0.

The *Beer-Lambert Law*, which indicates the linear relationship between absorbance and the concentration is represented as $A = \varepsilon bc$. A represents the aborbance of the sample. ε represents the molar absorptivity. b represents the solution path length and c represents the molar concentration.

Question 2 (20 points)

What volume of 2.00 M phosphate stock solution is required to make 25.0 mL of a 4.00 M solution?

50.0ml of 2.00M phosphate stock solution is required.

Let volume be x

$$4x = 25 * 2 \qquad x = \frac{25 \times 2}{4} = 12.5ml$$

Question 3 (15 points)

Please express the transmittance %T and absorbance A using original light intensity I_0 and final light intensity I. When %T increases, will A increase or decrease?

$$\%T = \left(\frac{I}{I_0}\right) \times 100$$

$$\text{A} = \text{-}\log_{10}(\frac{\%\text{T}}{100}) = 2 - \log_{10}(\%\text{T}) = 2 - (2 + \log_{10}\left(\frac{I}{I_0}\right) = \log_{10}\left(\frac{I}{I_0}\right)$$

When %T increases, A will decrease.

Question 4 (20 points)

Please list the chemical laboratory apparatus and their functions in the lab.

1. Spectrophotometer: To measure the %T. (Also A, but we do not use it)
2. 50- mL Volumetric flask: determine the volume of a liquid to make solutions of certain concentration
3. 1, 2, 5- mL Pipets and pipet bulb: To transfer and add liquid to make solutions of certain concentration
4. Cuvettes: To hold samples for spectroscopic analysis
5. 500- mL Beakers: To stir mix and heat liquids to make solutions of certain concentration

Question 5 (5 points)

Please list another application of spectrophotometric analysis and state the tested compound and the corresponding coloring agent

BCA method
Protein Determination
Coloring Agent: Cu2+ solution (Under base environment)

DATA SHEET

VC211 EXPERIMENT E3 DATASHEET: Spectrophotometric Analysis: Phosphates in Water

Name:_____	Student ID:_____	Section:_____
TA:_____	Group:_____	

Concentration of Phosphate Stock Solution:_____

Part A: Prepare 6 Standard Solution and 2 Solutions of Unknown Concentration

Sample	#1	#2	#3	#4	#5	#6	#7 A	#7 B
Volume (mL)								

Part B: Find λ_{opt}

λ (nm)					
A					

Part C: Find Absorbance of Prepared Samples with λ_{opt}

Sample	#1	#2	#3	#4	#5	#6
Absorbance (A)						

Part D: Find Absorbance of Solution of Unknown Concentration with λ_{opt}

Sample	#7 A	#7 B
Absorbance (A)		