Your responses to the rest of the questions in this part of the examination will be graded on the basis of the accuracy and relevance of the information cited. Explanations should be clear and well organized. Examples and equations may be included in your responses where appropriate. Specific answers are preferable to broad, diffuse responses.

Answer BOTH Question 5 below AND Question 6 printed on page 12. Both of these questions will be graded. The Section II score weighting for these questions is 30 percent (15 percent each).

5. A student is instructed to determine the concentration of a solution of $CoCl_2$ based on absorption of light (spectrometric/colorimetric method). The student is provided with a 0.10 M solution of $CoCl_2$ with which to prepare standard solutions with concentrations of 0.020 M, 0.040 M, 0.060 M, and 0.080 M.

   (a) Describe the procedure for diluting the 0.10 M solution to a concentration of 0.020 M using distilled water, a 100 mL volumetric flask, and a pipet or buret. Include specific amounts where appropriate.
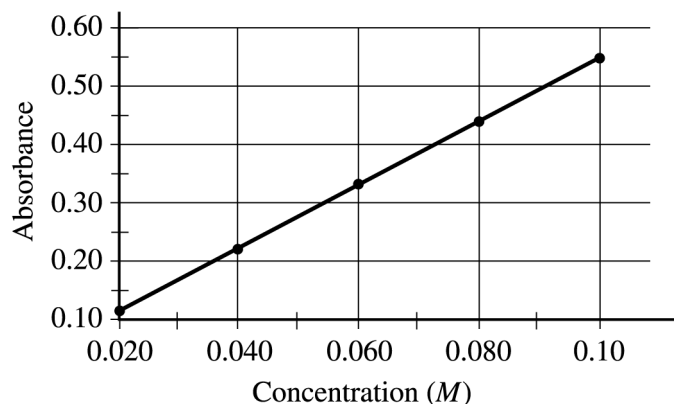
   The student takes the 0.10 M solution and determines the percent transmittance and the absorbance at various wavelengths. The two graphs below represent the data.
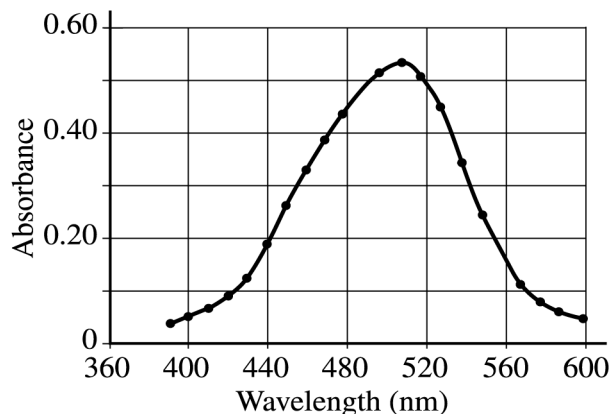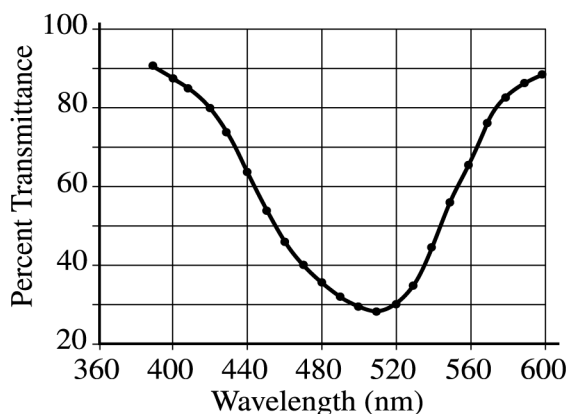
   (b) Identify the optimum wavelength for the analysis.

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The student measures the absorbance of the 0.020 M, 0.040 M, 0.060 M, 0.080 M, and 0.10 M solutions. The data are plotted below.

(c) The absorbance of the unknown solution is 0.275. What is the concentration of the solution?

(d) Beer's Law is an expression that includes three factors that determine the amount of light that passes through a solution. Identify two of these factors.

(e) The student handles the sample container (e.g., test tube or cuvette) that holds the unknown solution and leaves fingerprints in the path of the light beam. How will this affect the calculated concentration of the unknown? Explain your answer.

(f) Why is this method of determining the concentration of $CoCl_2$ solution appropriate, whereas using the same method for measuring the concentration of $NaCl$ solution would not be appropriate?

GO ON TO THE NEXT PAGE.