PreLab Assignment for Measuring Manganese Using Spectrophotometry

List 3 health effects associated with the intake of excessive manganese:

1.

2.

3.

In absorption spectroscopy the amount of light absorbed by a given sample at a specific wavelength is proportional to what two factors:

1.

2.

Suppose you need to do an absorption spectroscopy experiment using an orange colored solution. Approximately what wavelength(s) of light would be the worst to measure the absorbance at; what would be the best wavelength(s) of light to measure the absorbance at. Why? Explain your answers in one or two sentences.

Worst wavelength(s):

Best wavelength(s):

Explain:
A solution contains 0.60 mg/mL \( \text{Mn}^{2+} \). What minimum mass of \( \text{KIO}_4 \) must me added to 5.00 mL of the solution in order to completely oxidize the \( \text{Mn}^{2+} \) to \( \text{MnO}_4^- \)? Show all work.

A student is working to determine the concentration of a dissolved protein in a biological sample using absorption spectroscopy. She prepares a blank and two standard solutions containing known concentrations of dissolved protein. She chooses an appropriate wavelength, calibrates her instrument, and then obtains the following absorption data for her standard solutions:

<table>
<thead>
<tr>
<th>Concentration (M)</th>
<th>Absorbance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>0.013</td>
<td>0.046</td>
</tr>
<tr>
<td>0.039</td>
<td>0.138</td>
</tr>
</tbody>
</table>

Assuming that the path length \( L \) is 1.0 cm, what is the value of \( E \)? (show all work).

The same student now takes the biological sample containing an unknown quantity of dissolved protein and inserts it into the spectrometer. She obtains a reading that is off-scale (in other words her biological sample is too concentrated to measure). Undaunted by this result, she performs a dilution! A more dilute sample will have an absorption that can be measured by her spectrometer. She pipettes 20.00 mL of her sample into a 250.00 mL volumetric flask, adds deionized water to the index mark, and mixes the solution. She then pours a small sample of this diluted unknown solution into a cuvette and measures an absorbance of 0.228. What is the concentration of dissolved protein in her diluted unknown sample? Show all work.

Based on this result, what is the concentration of dissolved protein in her original (undiluted) unknown biological sample? Hint: calculate the dilution backwards. Show all work.