

Analytical Cumulative Exam

7 April 2016

Please answer all questions and use complete sentences. Include a drawing or equation if requested or you may include as a supplement to your written answer.

1. The use of absorbance detection for capillary chromatographic and electrophoretic separations is popular as it is considered a nearly universal mode of detection. However, ultimately absorbance detection is limited. In what ways is absorbance limited for capillary methods? Name two different solutions to absorbance-detection limitations that have been tried to reduce these limitations? (10 pts.)
2. Describe why lasers are often used for fluorescence measurements but not typically useful for absorbance measurements. A couple of equations are requested. (10 pts.)
3. What is Zeeman splitting? List at least two types of measurements it is used for. Why is it useful? (10 pts.)
4. Draw a diagram of a Michelson Interferometer. In what instrument is this typically a part? What are the advantages for using an interferometer? (15 pts.)
5. Describe how to perform an ELISA. (Note: Only a diagram is not a sufficient answer.) Be sure to discuss the two commonly used optical approaches for detection. (15 pts.)
6. Name three common analytical instruments that utilize the Fourier Transform. For each instrument describe how chemical property is encoded to a frequency. (15 pts.)
7. What is a charge-couple device? Describe an instrument that incorporates this component and demonstrates an advantage over alternative components. (15 pts.)
8. Answer one (and only one) from below for 10 pts.:
 - a. Explain how an avalanche photodiode operates.
 - b. Explain how pH can be measured with a fiber optic probe.
 - c. Distinguish between shot noise, flicker noise, white noise and environmental noise.