

## Analytical Cumulative Exam

1 December 2011

Please answer all questions and use complete sentences unless a drawing or equation is requested.

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 these methods? Name two different solutions to limitations that have been tried to reduce the impact of these limitations? (15 pts.)
2. Describe why lasers are often used for fluorescence measurements but not typically useful for absorbance measurements. (10 pts.)
3. What is Zeeman splitting? In what types of measurements is it used? Why is it useful? (10 pts.)
4. Draw a diagram of a Michaelson Interferometer. What chemical information is typically gained by using this equipment? (15 pts.)
5. What are the advantages associated with using a Michaelson Interferometer? (10 pts.)
6. 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.)
7. What is a charge-couple device? Describe 2 uses of these components in chemical instrumentation that demonstrate 2 of their advantages. (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.