Analytical Chemistry
Cumulative Exam
September 6, 2003
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Given the arsenal of analytical tools you’ve learned to use in the course of your education, solve the following problems in the most expedient and economical manner. Support your choice based on the detection limits, number of samples required, amount of time available for analysis, etc. Outline the procedure required completely, including any special arrangements, assumptions, sample treatments, controls, or calibrations that must be made. Each question is worth 20 points. Your score depends on how well you support and outline your recommendation in addition to the feasibility of your suggestion.

1. Determination of all elements present in the image of the shroud of Turin. (The salient point is that this is a priceless, archeological artifact.)

2. Determination of organic contaminants from poor production control in the output of a local methamphetamine laboratory.

3. Identification of the source of an oil spill discovered in the middle of the Atlantic Ocean.

4. Screening of approximately 3,000 water samples taken from various points in a major city’s sewer system. There is concern that the water has been contaminated by PbCrO$_4$. The samples are heterogeneous (sludge), and you need to find out if Pb or Cr are present at $>2$ ppm. City Council hearings are in 3 weeks.

5. Identification of bacteria contaminating the surf off Huntington Beach, CA. Several large stretches of the beach have had to be closed during recent summers due to persistent contamination events. The economic impact to local business and municipalities has been “serious.” Identification the source of the contamination may help authorities eliminate this problem.