10% 1. Why is it that in general the resolving power of the monochromator used in a flame atomic absorption spectrometer does not need to be as good as the one used in a ICP-atomic emission spectrometer?

6% 2. Which of following processes or properties that limits the sensitivity of the FAAS? Please choose and explain.

a. sample introduction
b. light intensity of the HCL
c. detection efficiency of the PM tube
d. poor resolution resulted from the monochromator

10% 3. A bullet was found in a victim's body at the crime seen, two days later a suspect was arrested with a suspected murder weapon, a handgun. If you were a forensic chemist, which of the following techniques would you choose to reasonably convince the judge that the bullet was actually fired from that gun. Please also give your reasons.

a. GC-MS
b. HPLC
c. NAA
d. X-Ray Fluorescence
e. AAS or AES

10% 4. A cell consisting a saturated calomel electrode and a lead ion electrode developed a potential of -0.4706 V when immersed in 50.00mL of a sample. A 5.00mL addition of standard 0.02000 M lead solution caused the potential to shift to -0.4490 V. Calculate the molar concentration of lead in the sample.

10% 5. Air in the vicinity of a fire power plant was analyzed for its SO_2 content by drawing the air through 50.0mL of 0.01081 M $Ce(SO_4)_2$ at the rate of 3.20L/min.

Reaction:

$$SO_2(g) + 2Ce^{4+} + 2H_2O \longrightarrow SO_4^{2-} + 2Ce^{3+} + 4H^+$$

Upon completion of a 75.00mim sampling period, the excess Ce(IV) was titrated with 13.95 mL of 0.03764 M Fe(II). Please calculate the SO_2 concentration in the air.

10% 6. Please draw instrumental block diagrams and optical path for AAS, IR, and UV.

12% 7. Calculate the absolute standard deviation for the following y values:
a) $y = -1.02(\pm 0.02) \times 10^7 - 3.54(\pm 0.2) \times 10^8$
b) $y = 0.0010(\pm 0.0005) \times 18.10(\pm 0.02) \times 200(\pm 1)$
c) $y = 100.2(\pm 0.08) - 99.62(\pm 0.06) + 0.200(\pm 0.004)$

10% 8. A solution containing a complex compound that has a molar absorptivity of 9.32×10^3 L cm^{-1} mol^{-1} at 470 nm.
a) What is the absorbance of a 6.24×10^{-5} M solution of the complex at 470 nm in a 1.00cm cell?
b) What is the percent transmittance of the solution described in (a)?
c) What is the molar concentration of the complex in a solution has the absorbance described in (a) when measured at 470 nm in a 5.00 cm cell?

10% 9. A gas chromatograph is equipped with two different detectors i.e., a electron capture detector and a flame ionization detector, which are connected in series in an attempt to measure halogenated and nonhalogenated hydrocarbons. Please choose a correct configuration between A and B, and also give your reasons.

A. GC — FID — ECD — RECODER

B. GC — ECD — FID — RECODER

12% 10. Please name and describe three different analytical techniques used to separate a mixture of chemical compounds based on their physical properties.