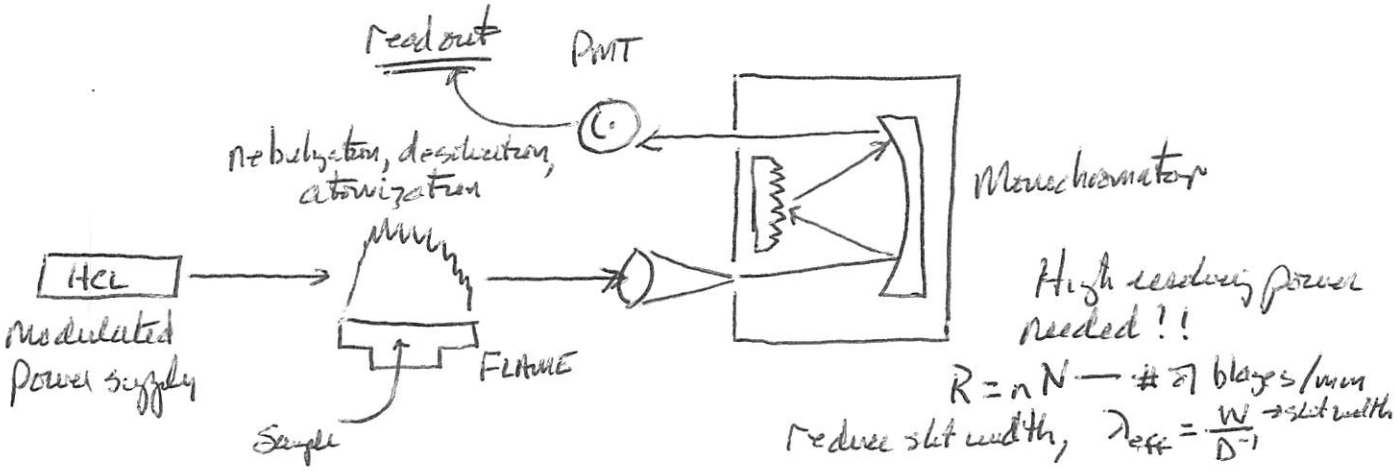
Name Answer Key

Quiz 5 (10 pts)
CEM 434
Fall 2016

1 (3 pts). Show the design and optical path of an instrument used in atomic absorption spectroscopy (AAS). Recall that wavelengths of absorption and emission are in the near UV and visible regions of the electromagnetic spectrum.



2 (2 pts). What are two distinct instrumental and spectral features of AAS that are distinctly different from molecular UV/Vis absorption spectroscopy.

1. High resolution needed in AAS → 0.001nm vs. 1-10nm
2. Individual hollow cathode lamps for each element.

3 (3 pts). Describe how the plasma in ICP-OES (optical emission spectroscopy) works to excite atoms in the gas phase leading to their emission of light. Also, indicate two advantages of ICP-OES over AAS.

Plasma = mixture of cations and electrons in the gas phase due to ionization of Ar or He.

Oscillating Ar^+ in the torch top region resulting from current flow through surrounding coils. Ar^+ ions have mass and their movement creates heat. The hot environment desolvates and atomizes elements introduced. Collisions with oscillating Ar^+ and the heat produce atoms in an excited state. These species relax by emission of light. The high temperature is useful for efficiently atomizing the sample and the inert environment from the minimizes formation of refractory oxides or other molecular species

0.015

4. (2 pts) A response curve with external standards for Pb^{+2} exhibited linearity with the following regression equation, y = 1.47 (µg/mL = ppm)x + ~~0.15~~. Assuming an orange juice sample yielded an absorption of 0.10 for Pb^{+2}, calculate the concentration of the metal ion.

$$Y = 1.47x + 0.15$$

$$\frac{Y - \overset{0.015}{\cancel{0.15}}\ \text{signal}}{1.47\ \text{signal/ppm}} = x = \frac{0.10 - 0.015\ \cancel{\text{signal}}}{1.47\ \cancel{\text{signal}}/\text{ppm}} = 0.058\ \text{ppm} = 58\ \text{ppb}$$