***CHEM312 Calibration Quiz*** *No outside sources, no other excel files are allowed to be used; please show all work.* Submit a completed spreadsheet file with worksheets for each of the 4 solved problems in Excel format with name.

1. **Chromatographic Analysis using an Internal Standard**
   a. In a chromatographic analysis, a solution containing 0.0837M Analyte X and 0.0666M Internal Standard (IS) gave peak areas of $A_x$= 423 and $A_{IS}$= 347. Calculate the response factor F showing equations & work.

   b. To analyze an unknown sample, 10.0mL of 0.146M IS was added to 10.0mL of X, and the mixture was diluted to 25.0mL. Calculate the concentration of the internal standard in the diluted solution.

   c. Analysis of the diluted solution prepared in part b gave good chromatographic separation with peak areas Ax= 553 and Ais= 582 for the analyte and internal standard. Calculate the concentration of the analyte in the diluted solution.

   d. Finally, calculate the concentration of the analyte in the original unknown sample.

2. **Modeling Electricity Consumption as Function of Home Size:** The data below are the electricity consumptions in kilowatt-hours per month from ten houses and the areas in square feet of those houses:

| Home Size | KW Hrs/Mnth |
|---|---|
| 1290 | 1182 |
| 1350 | 1172 |
| 1470 | 1264 |
| 1600 | 1493 |
| 1710 | 1571 |
| 1840 | 1711 |
| 1980 | 1804 |
| 2230 | 1840 |
| 2400 | 1956 |
| 2930 | 1954 |

   a. Use LINEST to develop a 2nd order model to predict monthly home energy use as a function of area.

   b. Write the mathematical equation for your model using appropriate units

   c. Manually calculate the following for your model showing all work:
      a. Total Sum of Squares
      b. Regression Sum of Squares
      c. Residual Sum of Squares

   d. Develop a plot of your data and model using best practices from this course.

   e. For a house area of 2020 square feet, use your model to predict the monthly energy use.

3. **Standard Addition Problem**: Arsenic was determined in blood serum by flame atomic emission spectroscopy. Varying volumes of an 8.56 ppm As standard were added to separate 5.00 mL aliquots of the serum (as indicated below) and diluted to 100.00 mL.

| Sample | Intensity |
|---|---|
| 5.00 mL Serum | 163 |
| 5.00 mL Serum + 5.00 mL As standard | 392 |
| 5.00 mL Serum + 10.00 mL As standard | 543 |
| 5.00 mL Serum + 15.00 mL As standard | 802 |
| 5.00 mL Serum + 20.00 mL As standard | 1,034 |
| 5.00 mL Serum + 25.00 mL As standard | 1,212 |

   a. Determine the arsenic concentration (in ppm units) in blood serum using standard addition and generate a plot of your data and model using best practices from this course.

   b. Calculate the uncertainty in your arsenic concentration estimate.

4. **Detection Limit Determination:** Graphite Furnace Atomic Absorption Spectroscopy was used to measure Pb levels in blood. From the Calibration data set below, determine the method detection limit in units of ppb.

| [Pb] (ppb) | Signal (mAu) |
|---|---|
| 0.50 | 3.76 |
| 1.50 | 9.16 |
| 2.50 | 15.03 |
| 3.50 | 20.42 |
| 4.50 | 25.33 |
| 5.50 | 31.87 |