Reactor Postlab for Chem 2 – Spring 2014

For the Reactor data, we will be graphing it by hand. We will also be determining the decay constant (k), the initial counts \( (A_0) \) and half-life \( (t_{1/2}) \) for the data. You will still need to record these values \((k, A_0, \text{ & } t_{1/2})\) on page 29 and answer the questions on that page as well.

(Pages 27-32 + 4 computer generated graphs for the simulation data + this handout will be due at your class time April 21-24.)

1. On the chart below, graph time (min) vs. counts /min. This should result in an exponential decay curve. Connect the datapoints with a curved line.

2. On the chart below graph time (min) vs. \( \ln(\text{counts / min}) \). This should result in a reasonably straight line. Connect the datapoints with a straight line.
3. Calculate the slope of the line for the linear plot. Where slope is rise over run or
\[ m = \frac{(y_2 - y_1)}{(x_2 - x_1)}. \]
For \( x_1 \) & \( x_2 \), use the first value & the last value collected. These are usually at 2 minutes and 10 minutes.
For \( y_1 \) & \( y_2 \), use the actual data that you calculated for \( \ln \) (cts/min).
Do not try and determine points from the graph.

4. Determine your initial (zero) values for counts / min, \( A_0 \), and \( \ln \) (counts / min), \( \ln A_0 \). Since \( \ln A_0 \) is equal to the y-intercept for the linear plot. Then we can use the equation for a line:
\[ y = mx + b \]
\[ b = y_0 - mx \]
\[ \ln A_0 = b \]

5. Determine the initial number of counts, \( A_0 \), where \( A_0 = e^{\ln A_0} \)

6. Determine the specific decay constant, \( k \) (min\(^{-1}\)), where \( k = -m \).

7. Estimate the half-life, \( t_{1/2} \), of the aluminum. On your exponential graph, draw horizontal lines at 10,000 and 5,000 counts / min. Whereever these lines cross the data, drop a vertical line. The distance between these two lines is the half-life. What is your estimated half-life in minutes?

8. Determine the actual half-life, \( t_{1/2} \), of the aluminum, where \( t_{1/2} = \frac{\ln 2}{k} \) & \( \ln 2 = 0.693 \).

(Note: Don’t forget to record values on page 29.)