Name: ______________________________ **Section#**: __________ **Desk#**: __________

Partners Name: ____ONLINE____________

Radioactivity Simulation Data

Group I (your first set of data)			**Group II (your second set of data)**		
Unknown #__900______			**Unknown #**__901______		
Time(min)	**Counts/min**	**ln(cts/min)**	**Time(min)**	**Counts/min**	**ln(cts/min)**
0	________	________	0	________	________
2	________	________	2	________	________
4	________	________	4	________	________
6	________	________	6	________	________
8	________	________	8	________	________
10	________	________	10	________	________
12	________	________	12	________	________
14	________	________	14	________	________
16	________	________	16	________	________
18	________	________	18	________	________
20	________	________	20	________	________
22	________	________	22	________	________
24	________	________	24	________	________
26	________	________	26	________	________
28	________	________	28	________	________
30	________	________	30	________	________
32	________	________	32	________	________

1. Prepare two graphs in Excel for each of the above sets of data (4 total graphs, separately graphed):
   a. Make 2 Graphs – Counts/min vs. time (exponential scatterplot graph)
   b. Make 2 Graphs – ln (counts/min) vs. time (linear scatterplot graph)
      Don't forget to put a title and axis labels on each graph.
   c. Add a trendline to each of the graphs. Display both the equation and the regression, R^2, value.

2. Using the data from the graphs calculate the following values (Hint: Use the trendline equations from the linear graphs).

k = ____________ 1/min	k = ____________ 1/min
$t_{1/2}$ = ____________ min	$t_{1/2}$ = ____________ min
$t_{3/4}$ = ____________ min	$t_{3/4}$ = ____________ min
$t_{7/8}$ = ____________ min	$t_{7/8}$ = ____________ min

*****Here is a hint about some of your calculations for the radioactivity lab.

These are the times required for 3/4 and 7/8 of the material to decay. So you will use the following equation:

$$\ln(N_o/N) = kt$$

To find $t_{3/4}$, start with N_o = 1 (or 100%). You want to know when 3/4 or the material has decayed, so 1/4 of the material is actually left. Therefore N = 1/4. If you plug in N_o, N, and k (you get k from graphing the data), you can solve for $t_{3/4}$. You will do the calculation the same way for $t_{7/8}$. However when 7/8 of the material has decayed, 1/8 is left over (so N = 1/8).

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Partner's Name(s): ____ONLINE____

Reactor Data Spring 2012

(This is a replacement datasheet for page 29 in the green book.)

Time(min)	**Counts/min**	**ln(cts/min)**
0		
1	xxx	xxx
2	10508	
3	7581	
4	5647	
5	4056	
6	3044	
7	2086	
8	1554	
9	1254	

1. Prepare two graphs on graph paper provided for the above data (separately graphed):
   a. Make 1 Graph – Counts/min vs. time
   b. Make 1 Graph – ln (counts/min) vs. time
      Don't forget to put a title and axis labels on each graph.
   c. Add a trendline to the "ln (counts/min) vs. time" graph.
      1. Determine the slope of the trendline: $m = (y_2 - y_1) / (x_2 - x_1)$.
      2. Determine the equation for the line: $y = mx + b$.

2. Using the data from the trendline equations calculate the following values.

$k =$ ____________ min^{-1}

A_o (where $t = 0$) = ____________ counts/min

lnA_o (where $t = 0$) = ____________ ln(cts/min)

$t_{1/2} =$ ____________ min

$t_{3/4} =$ ____________ min

$t_{7/8} =$ ____________ min

3. Calculate the Percent Error for the Half Life of Al-28. Show % Error Calculation here:

% Error Eqn: From the reference listed below the **half life of ^{28}Al is 2.2414 minutes**.
This will be your theoretical (accepted) value.
The value that you calculate from your graph will be your experimental value.

J. K. TULI, Nuclear Wallet Cards, Sixth Edition, National Nuclear Data Center, Brookhaven National Lab., Upton, NY, 2000, 74 pp.

4. List the conditions of the reactor set up (they will be on the white board):

$$^{27}_{13}Al + ^{1}_{0}n \rightarrow ^{28}_{13}Al^* \rightarrow ^{28}_{14}Si + ^{0}_{-1}\beta + \gamma$$

Reactor Power: 100 Thermal Watts
Neutron flux ~1×10^9 / cm^2 / sec

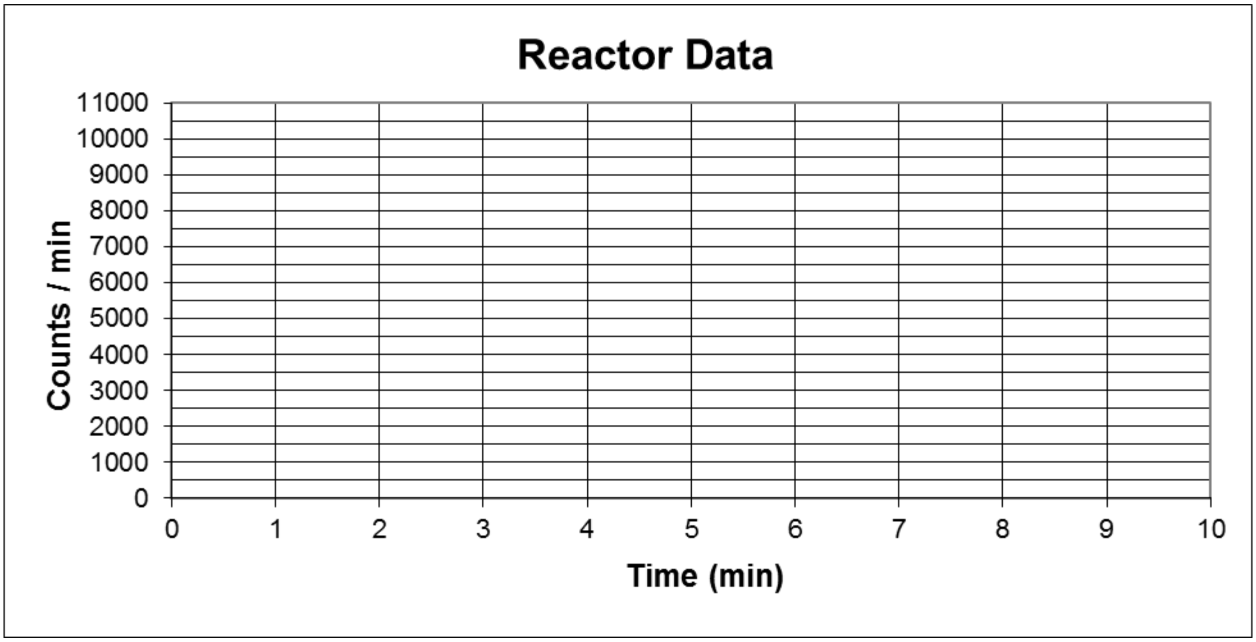
Exposure time = 120 seconds
100 mg of Al-27 Foil

Reactor Postlab for Chem 2 – Spring 2012

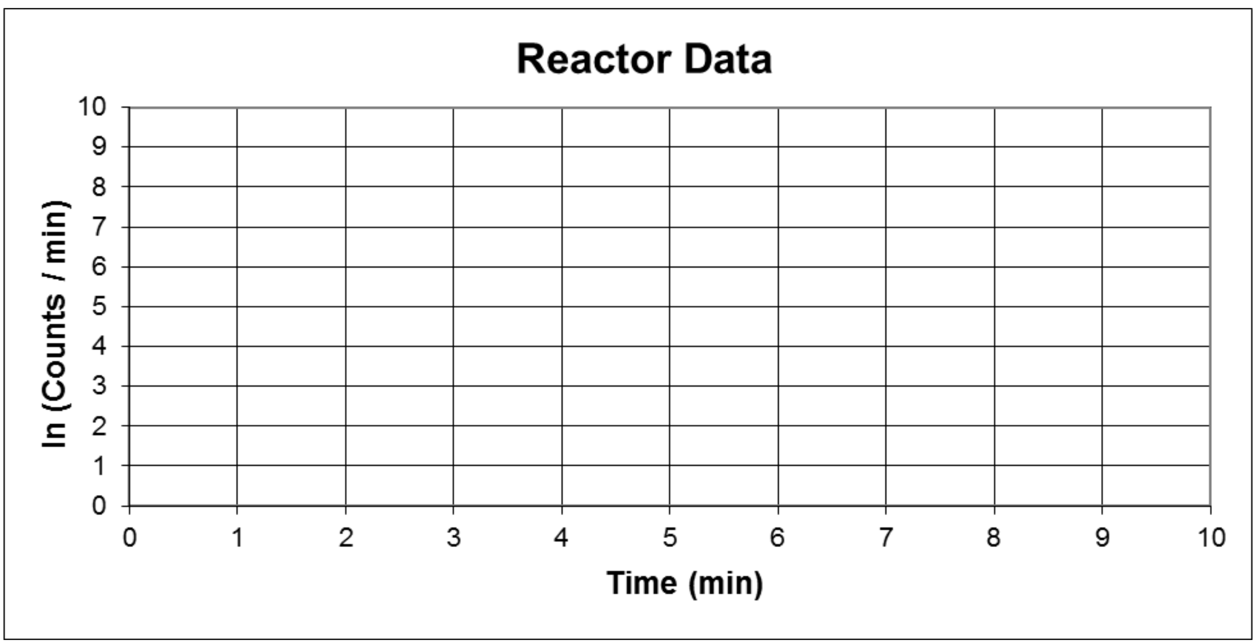
We will be graphing by hand the Reactor data presented in the video. We will also be determining the decay constant (k), the initial counts (A_o) and half-life ($t_{1/2}$) for the data. (Note: You will still need to record these values on **page 29** and answer the questions on that page.)

Graphing Directions:

1. On the chart below, **graph time (min) vs. counts /min** for the **reactor data**. The graphed data should result in an exponential decay curve. Connect the data points with **a curve**.



2. On the chart below graph time (min) vs. ln (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

$$\mathbf{m = (y_2 - y_1) / (x_2 - x_1).*}$$

(*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, $\mathbf{A_o}$, and ln (counts / min), $\mathbf{\ln A_o}$. Since **$\ln A_o$ is equal to the y-intercept** for the linear plot. Then we can use the equation for a line:

$$\mathbf{y = mx + b} \qquad\qquad \mathbf{b = y - mx}$$

5. Determine the initial number of counts, $\mathbf{A_o}$, where $\mathbf{A_o = e^{(\ln Ao)}}$

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

7. Estimate the half-life, $\mathbf{t_{1/2}}$, of the aluminum. On your exponential graph, draw horizontal lines at <u>10,000 and 5,000 counts / min</u>. 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, $\mathbf{t_{1/2}}$, of the aluminum, where $\mathbf{t_{½} = \ln 2 / k}$ & $\mathbf{\ln 2 = 0.693.}$