Nuclear Graphing 101

Since several people have asked:

How to make the graphs?

| 🐱 Microsoft Excel - nuclear_211 | | | | | | | | | | | | | | | |
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| 5 | 4 | 23262 | 10.05458 | | | | | | | | | | | | _ |
| 6 | 5 | 21177 | 9.960671 | | | | | | | | | | | | |
| 7 | 6 | 19460 | 9.876116 | | | | | | | | | | | | |
| 8 | 1 | 17781 | 9.785886 | | | | | | | | | | | | |
| 9 | 8 | 16293 | 9.698491 | | | | | | | | | | | | |
| 10 | 9 | 14996 | 9.615539 | | | | | | | | | | | | |
| 11 | 10 | 13542 | 9.513551 | | | | | | | | | | | | |
| 12 | 11 | 12581 | 9.439943 | | | | | | | | | | | | |
| 13 | 12 | 11439 | 9.344/84 | | | | | | | | | | | | |
| 14 | 13 | 0427 | 9.251866 | | | | | | | | | | | | |
| 15 | 14 | 9437 | 9.152393 | | | | | | | | | | | | |
| 10 | 15 | 7015 | 0.077901 | | | | | | | | | | | | |
| 17 | 17 | 7013 | 9.997701 | | | | | | | | | | | | |
| 10 | 18 | 6647 | 8 801921 | | | | | | | | | | | | |
| 20 | 19 | 6152 | 8 724533 | | | | | | | | | | | | |
| 20 | 20 | 5647 | 8.63888 | | | | | | | | | | | | |
| 22 | 20 | 5159 | 8 548498 | | | | | | | | | | | | |
| 23 | 22 | 4561 | 8.425297 | | | | | | | | | | | | |
| 24 | 23 | 4222 | 8.348064 | | | | | | | | | | | | |
| 25 | 24 | 3848 | 8.255309 | | | | | | | | | | | | |
| 26 | 25 | 3629 | 8.196712 | | | | | | | | | | | | |
| 27 | 26 | 3163 | 8.059276 | | | | | | | | | | | | |
| 28 | 27 | 2960 | 7.992945 | | | | | | | | | | | | |
| 29 | 28 | 2711 | 7.905073 | | | | | | | | | | | | |
| 30 | 29 | 2435 | 7.797702 | | | | | | | | | | | | |
| 31 | 30 | 2298 | 7.739794 | | | | | | | | | | | | |
| 32 | 31 | 2074 | 7.637234 | | | | | | | | | | | | |
| 33 | 32 | 1905 | 7.552237 | | | | | | | | | | | | - |
| I4 4 ► H\Sh | eet1 \Sheet 2 | 2 / Sheet3 | / | | | | | | • | | | | | | |
| Ready | | | | | | | | | | | | | | | |

1. Choose the chart Wizard Button or under the pull down menu for "Insert" choose "chart". Choose XY (Scatter) plot.

(*Note: The Line plots for some reason do not calculate the values for the trendlines accurately.*)



| Chart Wizard - | Step 2 of 4 - Chart Source Data | ? × |
|------------------------------------|--|----------|
| Data Range | Series | |
| To create workshee want in t | e a chart, click in the Data range box. Then, on the et, select the cells that contain the data and labels you he chart. | |
| Data range: | <u> </u> | <u>.</u> |
| Series in: | O <u>R</u> ows O Columns | |
| | Cancel < <u>B</u> ack <u>N</u> ext > Ein | iish |

Choose the tab labeled "Series". Then Add. It will add "Series 1".

| Chart Wizard - Step 2 of 4 - Chart Source Data | ? × |
|---|-----|
| Data Range Series | |
| | |
| | |
| | |
| | |
| 0.0 | |
| 0.4 | |
| | |
| 0 0.2 0.4 0.6 0.8 1 1.2 | |
| Series Name: I X Values: I Y Values: I Add Remove | |
| Cancel < <u>B</u> ack <u>N</u> ext > <u>F</u> inis | h |

Click on the red arrow to the right of the "X Values" box. This will take you back to your data. Choose the "time" in minutes. Then hit the red arrow again and it will take you back to your series box.

Click on the red arrow to the right of the "Y Values" box. This will take you back to your data. Choose the "counts per minute". Then hit the red arrow again and it will take you back to your series box.

| Chart Wizard - Step 3 of 4 - | Chart Options | ? × |
|------------------------------|--------------------------------------|------------------|
| Titles Axes Gridline | s Legend Data Labels | |
| Chart <u>title:</u> | 30000 | |
| Value (X) axis: | 25000 | - 1 |
| <u>V</u> alue (Y) axis: | 15000 | Series1 |
| Second category (X) axis: | | _ |
| Second value (Y) axis: | | 40 |
| | | |
| | Cancel < <u>B</u> ack <u>N</u> ext > | - <u>F</u> inish |

Next.

Your Chart Title should be your unknown number or "Reactor Data".

Your x values are time (minutes).

Your y values are counts per minute.

| Chart Wizard - Step 3 of 4 - Chart Options | | | | | | | | | |
|---|--|--------|--|--|--|--|--|--|--|
| Chart Wizard - Step 3 of 4 - Chart Titles Axes Gridlines Leg Chart title: Unknown #211 Unknown #211 Value (X) axis: Time (min) Unknown #211 Value (Y) axis: Counts per Minute Second category (X) axis: Example 1 | Options gend Data Labels Unknown #211 30000 25000 15000 15000 5000 | ? × | | | | | | | |
| Second value (Y) axis: | 0 10 20 30 40 Time (min) | | | | | | | | |
| Car | ncel < <u>B</u> ack <u>N</u> ext > | Einish | | | | | | | |

Next.

| Chart Wizard - Step 4 of 4 - Chart Location | | | | | | | | | |
|---|-----------------|---------------------|----|--|--|--|--|--|--|
| Place chart: - | | | | | | | | | |
| | C As new sheet: | Chart1 | | | | | | | |
| | • As object in: | Sheet2 | • | | | | | | |
| | Cancel | < Back Next > Finis | ;h | | | | | | |

If you choose to place the chart in the sheet, then you can print multiple graphs at a time. When a chart is assigned a new sheet, it will print individually. We recommend choosing the "object" in sheet option.

Select Finish.

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| 5 | 4 | 23262 | 10.05458 | | | | | | | | | | | | |
| 6 | 5 | 21177 | 9.960671 | | 300 | | | | | | | | | | |
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| 9 | 8 | 16293 | 9.698491 | | 200 |)00 + | <u> </u> | | | | | | | | |
| 10 | 9 | 14996 | 9.615539 | | a 150 | | - ×. | | | | | | | | |
| 11 | 10 | 13542 | 9.513551 | | <u>a</u> 130 | | | And a | | | | | | | |
| 12 | 11 | 12581 | 9.439943 | | E 100 | | | | *** | | | | | | |
| 13 | 12 | 11439 | 9.344784 | | <u> </u> |)00 | | | | *** | • . | | | | |
| 14 | 13 | 10424 | 9.251866 | | 0 | | | | | | ****** | | | | |
| 15 | 14 | 9437 | 9.152393 | | | 0 | , , | 10 | 15 | | 20 | ~ | | | |
| 16 | 15 | 8760 | 9.077951 | | | U | 5 | 10 | 15 | 20 25 | 30 | 35 | | | |
| 17 | 16 | 7815 | 8.9638 | | | | | | Time (m | in) | | | | | _ |
| 18 | 17 | 7243 | 8.887791 | | | | | | | | | | | | |
| 19 | 18 | 6647 | 8.801921 | | | | | | | | | | | | _ |
| 20 | 19 | 6152 | 8.724533 | | | | | | | | | | | | |
| 21 | 20 | 5647 | 8.63888 | | | | | | | | | | | | _ |
| 22 | 21 | 5159 | 8.548498 | | | | | | | | | | | | |
| 23 | 22 | 4561 | 8.425297 | | | | | | | | | | | | |
| 24 | 23 | 4222 | 8.348064 | | | | | | | | | | | | |
| 25 | 24 | 3848 | 8.255309 | | | | | | | | | | | | |
| 26 | 25 | 3629 | 8.196712 | | | | | | | | | | | | |
| 27 | 26 | 3163 | 8.059276 | | | | | | | | | | | | |
| 28 | 27 | 2960 | 7.992945 | | | | | | | | | | | | |
| 29 | 28 | 2711 | 7.905073 | | | | | | | | | | | | |
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| i | ieet1) Sheet 2 | 2 / Sheet3 , | / | | | | | | | | | | | | |
| Ready | | | | | | | | | | | | | r | NUM | |

If there is only one series, I generally left click on the "Series 1" box in the graph and delete it.

Repeat using the ln cts/min for y.

How to make trendlines?

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|-------------------------|---|---------------------|---|--|----------------------------------|--|--|--|--|
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| 2 | | 275/3 | 10.2235 | 211 | | | | | |
| 3 | 2 | 27:040 | 10.2235 | | | | | | |
| | | 20400 | 10.1423 | - | | | | | |
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| 16 | 15 | 8760 | 9.077951 | time (min) | | | | | |
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| 33 | 32 | 1905 | 7.552237 | | | | | | |
| | Sheet1 / Sheet2 |),Sheet3 | / | | | | | | |
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Right click over the data (the blue diamonds). Choose the option "add trendline". Under "Type" you want to choose "Exponential" for the counts/min and "Linear" for the ln cts/min graphs.

| Add Trendline | × |
|-----------------------|-----------|
| Type Options | |
| Trend/Regression type | |
| Linear Logarithmic | Order: |
| Power Exponential | Period: |
| Based on covies: | |
| Series1 | |
| V | |
| | |
| | |
| | OK Cancel |

Click on the "Options" tab and check the last 2 boxes: "Display Equation" and "Display R-squared". The R^2 tells how close the regression fit of the trendline is to the given data. For the simulated data it is probably 99+% or 0.99+. For the reactor data, you might get a more meaningful regression value.

| Add Trendline | × |
|--|---|
| Type Options Trendline name • <u>A</u> utomatic: Linear (Series1) • <u>C</u> ustom: | |
| Forecast Eorward: 0 Backward: 0 Set intercept = 0 Display equation on chart Display R-squared value on chart | |
| OK Cancel | |

If you did it right, the graph should look like this.



If you did it **wrong** the graph will look like this and you need to go back and change your trendline from linear to exponential.



Another way that people have been doing it **wrong** is by choosing logarithmic instead of exponential. If that is the case, your graph will look like this.



You don't have to redo the graphs. Just right click on the trendline. You will get the option of format trendline. Then under type just choose exponential and the equations will automatically update.

How to get Zero Values?

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| 6 | | 5 | 21177 | 9.960671 | | 30000 |) | | | | | | | | | |
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| 16 | | 15 | 8/60 | 9.077951 | | | | t | ime (min | ` | - | | | | | _ |
| 17 | | 16 | 7815 | 8.9638 | | | | | , (iiiii | , | | | | | | |
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| 4 4 | ► ► She | et1 / Sheet2 | / Sheet3 / | / | | | | | | | | | | | | |
| Read | / | | | | | | | | | | | | | 1 | NUM | |

You get your zero values from the trendline equations on the graphs.

| For the exponential graph | $A = Ao e^{-kt}$ | Ao = cts/min zero value |
|---------------------------|------------------------|-----------------------------------|
| For the linear graph | $\ln A = -kt + \ln Ao$ | $\ln Ao = \ln cts/min zero value$ |

In the graphs above for unknown 211

| time (min) | counts/min | ln counts/min |
|------------|------------|---------------|
| 0 | 33,293 | 10.413 |

My "k" value is 0.0896 and my half life would be (ln 2/0.0896).