Instructions for using digital technology

PhyPhox

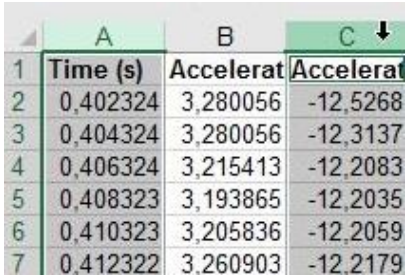
You can export the data you have collected in the PhyPhox app to your computer by selecting ***Export Data*** (in the menu at the right top of the app) → ***Excel format***, and then send them to your email (drive or any platform that you can access on your computer). Download the data to your computer and open it in Excel.

*You can always save the experimental data by selecting **Save experiment state** in the menu. Data will then remain visible to you at the homepage of the app.*

Excel

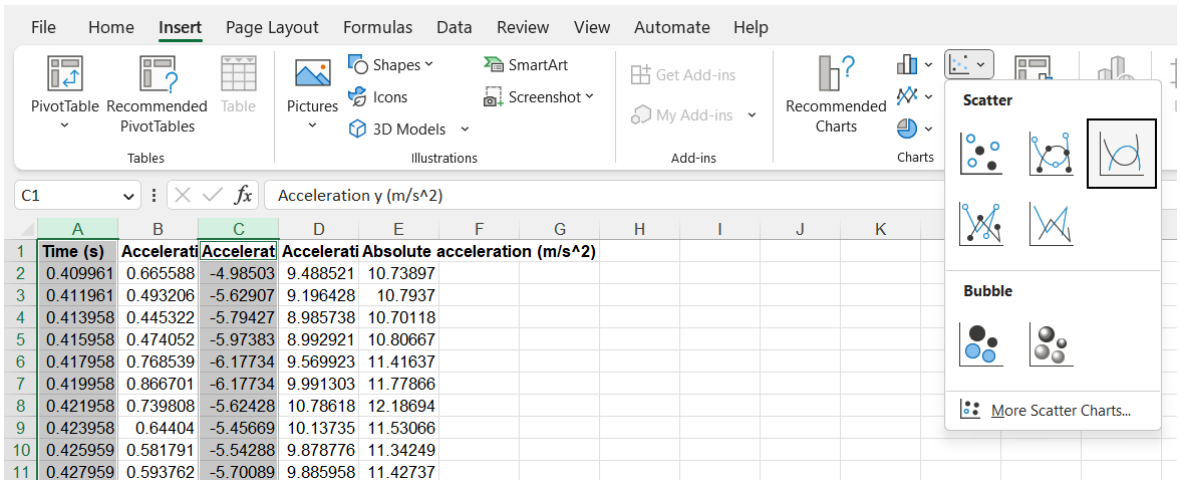
Draw a graph

First, you need to select the data that you want to display in the graph ($a - t$). Select the time column by clicking the letter of that column. To select the second column with the first column still being selected, you must hold down **CTRL** when selecting a new column. (The data that is marked first will be the x-axis of the graph, and the one marked second y -axis of the graph)



	A	B	C
1	Time (s)	Accelerat	Accelerat
2	0,402324	3,280056	-12,5268
3	0,404324	3,280056	-12,3137
4	0,406324	3,215413	-12,2083
5	0,408323	3,193865	-12,2035
6	0,410323	3,205836	-12,2059
7	0,412322	3,260903	-12,2179

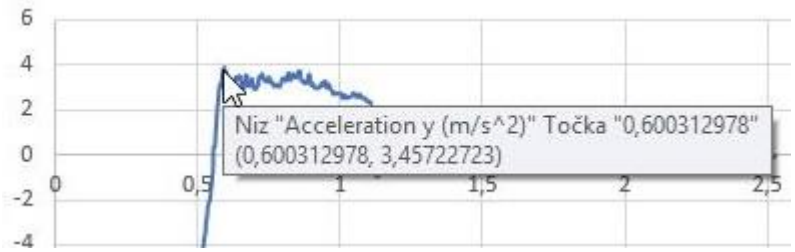
To draw a graph select ***Insert → Scatter → Scatter with Smooth Lines***.



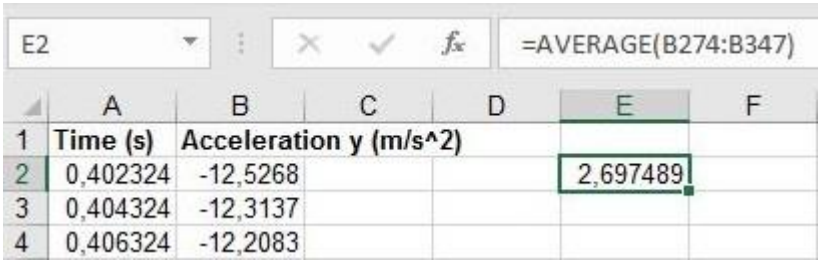
	A	B	C	D	E	F	G	H	I	J	K
1	Time (s)	Accelerati	Accelerat	Accelerati	Absolute acceleration (m/s^2)						
2	0.409961	0.665588	-4.98503	9.488521	10.73897						
3	0.411961	0.493206	-5.62907	9.196428	10.7937						
4	0.413958	0.445322	-5.79427	8.985738	10.70118						
5	0.415958	0.474052	-5.97383	8.992921	10.80667						
6	0.417958	0.768539	-6.17734	9.569923	11.41637						
7	0.419958	0.866701	-6.17734	9.991303	11.77866						
8	0.421958	0.739808	-5.62428	10.78618	12.18694						
9	0.423958	0.64404	-5.45669	10.13735	11.53066						
10	0.425959	0.581791	-5.54288	9.878776	11.34249						
11	0.427959	0.593762	-5.70089	9.885958	11.42737						

Determination of mean and standard error

From the graph, determine in which time interval the acceleration is approximately constant. When you place the mouse cursor on a point on a graph, the coordinates of that point will appear on the screen.

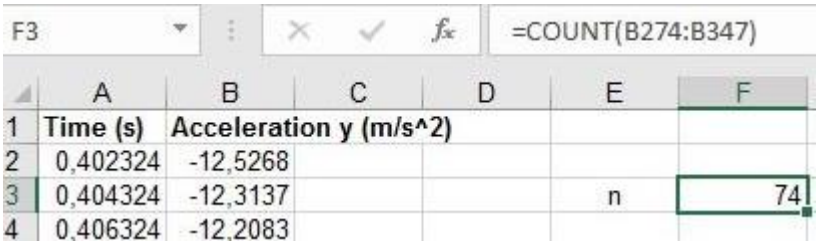


You can calculate the mean by using the **AVERAGE** function. In the cell where you want to calculate, type =AVERAGE(. Then select the array of cells for which you want to count the mean, close the parenthesis, and press Enter.

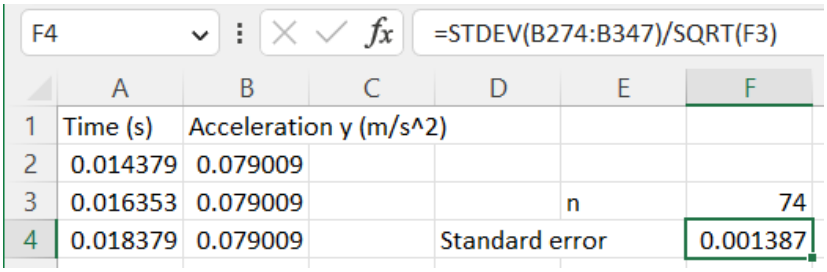


	A	B	C	D	E	F
1	**Time (s)**	**Acceleration y (m/s^2)**				
2	0,402324	-12,5268			2,697489	
3	0,404324	-12,3137				
4	0,406324	-12,2083				

Standard error of the mean can be calculated with the command **=STDEV(array of cells)/SQRT(n)**, where n is the number of data you have taken into the calculation. You can determine n with command **=COUNT(array of cells)**.



	A	B	C	D	E	F
1	**Time (s)**	**Acceleration y (m/s^2)**				
2	0,402324	-12,5268				
3	0,404324	-12,3137			n	74
4	0,406324	-12,2083				



	A	B	C	D	E	F
1	Time (s)	Acceleration y (m/s^2)				
2	0.014379	0.079009				
3	0.016353	0.079009			n	74
4	0.018379	0.079009		Standard error		0.001387

Note: Make sure you start each command with "=" because without it, Excel will take your command as text.