Physics 1021 Labs

Welcome!
Welcome to the labs!

Check your schedule!

Do your prelab quiz:


and submit with your report.
Use of Graphs

In experiments, we collect sets of data.

To most effectively use the data, we plot a graph, then draw meaning from that graph.

We determine the meaning by comparing the known physics equations to the equations that describe the graph.
Example

In Experiment 1 of P 1050, we examined mass vs volume of aluminium cylinders.

Mass and volume were measured and one set of data was:

<table>
<thead>
<tr>
<th>Cylinder</th>
<th>Volume (cm³)</th>
<th>Mass (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.314</td>
<td>22.50</td>
</tr>
<tr>
<td>2</td>
<td>34.110</td>
<td>91.95</td>
</tr>
<tr>
<td>3</td>
<td>22.700</td>
<td>61.30</td>
</tr>
<tr>
<td>4</td>
<td>13.300</td>
<td>36.10</td>
</tr>
</tbody>
</table>
Finally, we use the slope to determine some physical information about our system.

What is the general equation for our graph?

\[ y = m x + b \]

What physics equation contains our variables?

\[ M = \rho V + 0 \]
General Approach

Ask:
1) What data have we collected and what do we want to find?
2) Write the physics equation containing those variables.
3) Plot the data.
4) Compare the physics equation to the equation for the graph.
5) Use the comparison to draw your conclusions.
General Approach
What data have we collected and what do we want to find?

EXAMPLE:

We measure velocity vs time for a falling object.

We want to find acceleration and initial velocity.

<table>
<thead>
<tr>
<th>Velocity (m/s)</th>
<th>Time (s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.699</td>
<td>0.000</td>
</tr>
<tr>
<td>1.202</td>
<td>0.0523</td>
</tr>
<tr>
<td>1.574</td>
<td>0.0883</td>
</tr>
<tr>
<td>1.866</td>
<td>0.1180</td>
</tr>
<tr>
<td>2.091</td>
<td>0.1430</td>
</tr>
<tr>
<td>2.336</td>
<td>0.1660</td>
</tr>
<tr>
<td>2.512</td>
<td>0.1860</td>
</tr>
<tr>
<td>2.718</td>
<td>0.2050</td>
</tr>
</tbody>
</table>
General Approach

Plot the data.

Velocity (m/s)

Time (s)

Linear Fit For: Data Set: Velocity
y = mx + b
m (Slope): 9.823 m/s/s
b (Y-Intercept): 0.6977 m/s
Correlation: 0.9999
Std. Dev. of Slope: 0.05628 m/s/s
General Approach: Example 3
What data have we collected and what do we want to find?

EXAMPLE 3:
And now for something completely different...

Given:
Energy, Speed

Want to find:
Mass of the object

<table>
<thead>
<tr>
<th>Energy (J)</th>
<th>Speed (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.56</td>
<td>1.91</td>
</tr>
<tr>
<td>8.29</td>
<td>2.58</td>
</tr>
<tr>
<td>11.36</td>
<td>3.02</td>
</tr>
<tr>
<td>14.32</td>
<td>3.38</td>
</tr>
<tr>
<td>16.32</td>
<td>3.61</td>
</tr>
<tr>
<td>19.36</td>
<td>3.94</td>
</tr>
<tr>
<td>21.38</td>
<td>4.14</td>
</tr>
<tr>
<td>24.13</td>
<td>4.39</td>
</tr>
</tbody>
</table>
Your turn

You have collected position and time data for an object starting from rest.

Use kinematics to determine the acceleration (m/s²) and the initial position (m).

Create a plot in Graphical Analysis, and write the reasoning and the answers directly on the printout.

\[
v_x = v_{x0} + a_x t
\]

\[
v_x^2 = v_{x0}^2 + 2a_x(x - x_0)
\]

\[
x = x_0 + v_{0x} t + \frac{1}{2}a_x t^2
\]
Graphical Analysis

Open Graphical Analysis by clicking on the icon below.

You may autoscale your data by clicking Analyze then Autoscale Graph then Autoscale.

Fit a straight line to the data by clicking on Analyze then Linear Fit.

Print your graph by selecting select File then Print.

Add your names to the notes box.

Show all workings on your printed graph.