Physics: Graphing Procedures and Formatting

In physics it is frequently useful and/or necessary to represent your findings in the form of a graph. Graphs can reveal relationships and patterns that are not evident from the raw data of an experiment. As with lab reports, there are standard conventions (rules) that **must** be followed when creating graphs. All your graphs must be hand drawn (do not use computer programs to create the graph). Follow the instructions below.

TYPE OF GRAPH PAPER REQUIRED

Always use ***fine graph paper*** (1 mm divisions). Photocopied graph paper is available from your physics teacher.

TITLE OF GRAPH

- Give the graph a ***descriptive title*** that names the measured quantities and describes the situation that the graph represents. For example, instead of using a vague and unspecific title such as, *"Velocity vs. Time graph"*, you should write *"Velocity vs. Time Graph for a 5.0 kg ball rolling down a ramp angled at 23.0° to the horizontal"*.
- The name of the ***dependent variable (y axis)*** should be stated first and the name of the ***independent variable (x axis)*** should be stated second i.e.*"(dependent) vs. (independent) ..."* [refer to page 2 for info on variables]

YOUR NAME and the DATE on which the experiment was performed – i.e. Your Copyright

Include **your name** and the **date** on which you performed the experiment. The graph is a representation of your original research. Your name and the date ensure that you get appropriate credit and recognition for your work.

VARIABLES AND AXES

- The **INDEPENDENT** (manipulated) variable must be represented on the **x axis**
- The **DEPENDENT** (responding) variable must be represented on the **y axis**
- Each axis **must** have the following **4 attributes**:
  i. ***label*** indicating the name of variable that was measured. e.g. ***velocity***
  ii. ***symbol*** for the variable expressed in "quotation marks". e.g. ***"v"***
  iii. ***symbol for the unit*** expressed within (brackets). e.g. **(m/s)**
  iv. ***scale*** (numbers marked along the axis): Choose scales for the x and y axes so that you ***use the whole piece of graph paper*** (or as much of it as possible). Your graph must not be smaller than half the size of the graph paper.
- Mark each data point with a **cross (+)**, when you are representing a **measured quantity**. Other shapes for data points are NOT acceptable in physics. The cross is used because it is close in shape to "error bars", which is the standard format used in professional research reports (if you continue to study physics in College or University you will learn to use "error bars" for plotting data).
- If a quantity is **counted** (rather than measured), a **dot** should used to represent the data point. Counted quantities are exact numbers, with no uncertainty (e.g. the number of students in a room is a counted, exact, quantity). Since there is no uncertainty, "error bars" are not relevant.

Since baking bread requires that a specific oven temperature be maintained over a specific period of time, ***sustained oven temperature*** could be the ***dependent variable*** in this investigation. A possible ***independent variable*** that the researcher might choose to investigate is the ***colour of the interior surface*** of the solar oven. In the experiment, only the colour of the interior surface should be varied (changed) and tested for sustained oven temperature. All other factors (variables) must be kept constant (e.g. there must be no change in the shape of the oven, brightness of heat source/sun, location within the oven where the thermometer is placed, etc, etc). In this way, the researcher will be able to determine whether or not the oven temperature depends on the colour of the interior surface.

Examples of Solar Ovens:

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Slope of example graph #1

* To calculate slope, choose points from the line of best fit; Do NOT use points from the data table.

$$\text{Slope} = \frac{\Delta y}{\Delta x} = \frac{y_2 - y_1}{x_2 - x_1}$$

$$= \frac{F_2 - F_1}{l_2 - l_1} = \frac{9.4\,N - 0.0\,N}{0.50\,m - 0.075\,m}$$

Slope = 22 N/m

equation of graph #1

$y = mx + b$

$\therefore F = (22\,N/m)\,l - 1.6\,N$

Data Table for example graph #1

Applied Force vs length of a spring stretched horizontally

Force required (N) (±0.05N)	Spring length (m) (±0.01m)
0.70	0.10
2.50	0.20
5.50	0.30
7.10	0.40
10.20	0.50
11.90	0.60
[illegible]	[illegible]

Example graph #1: Straight line graph

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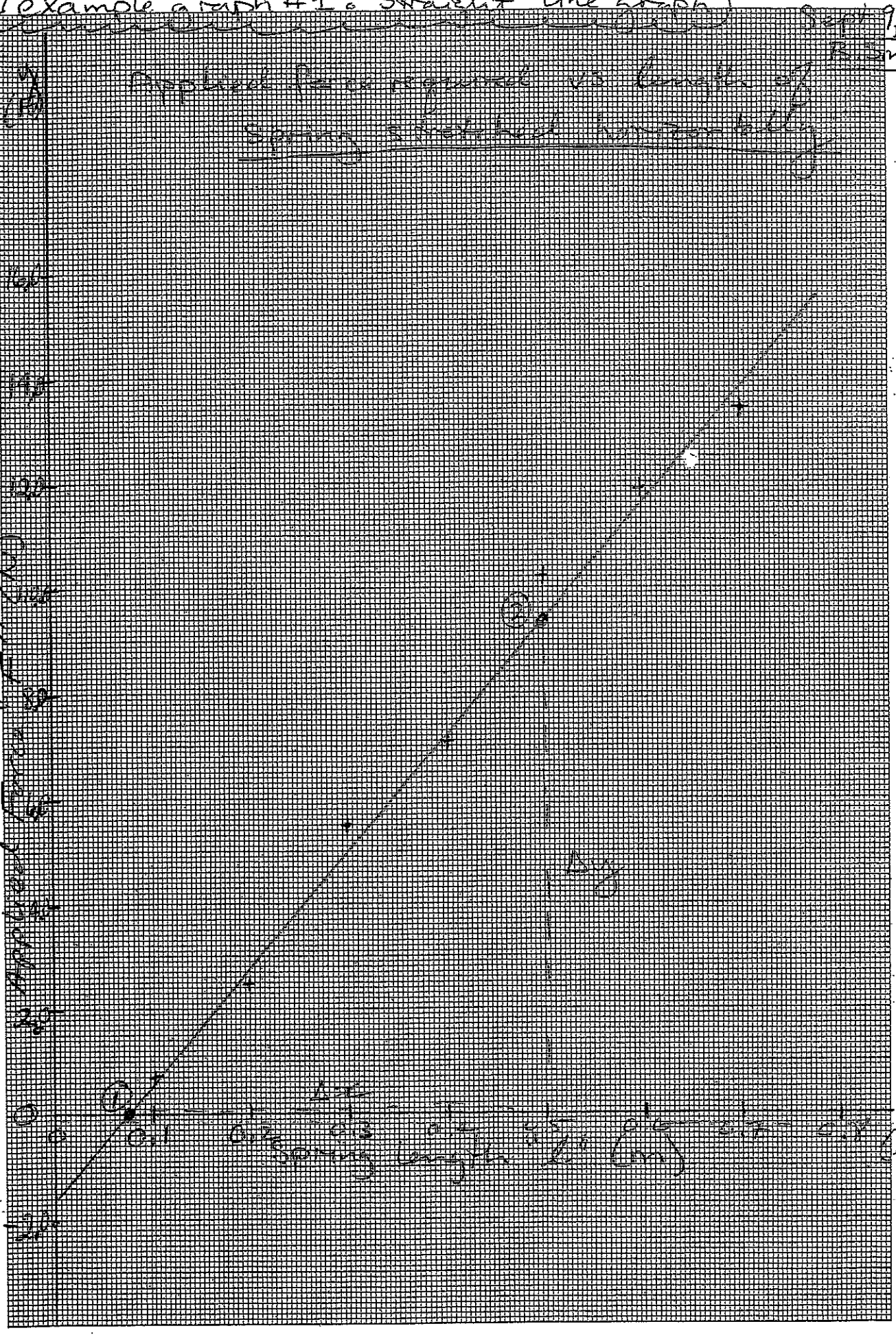
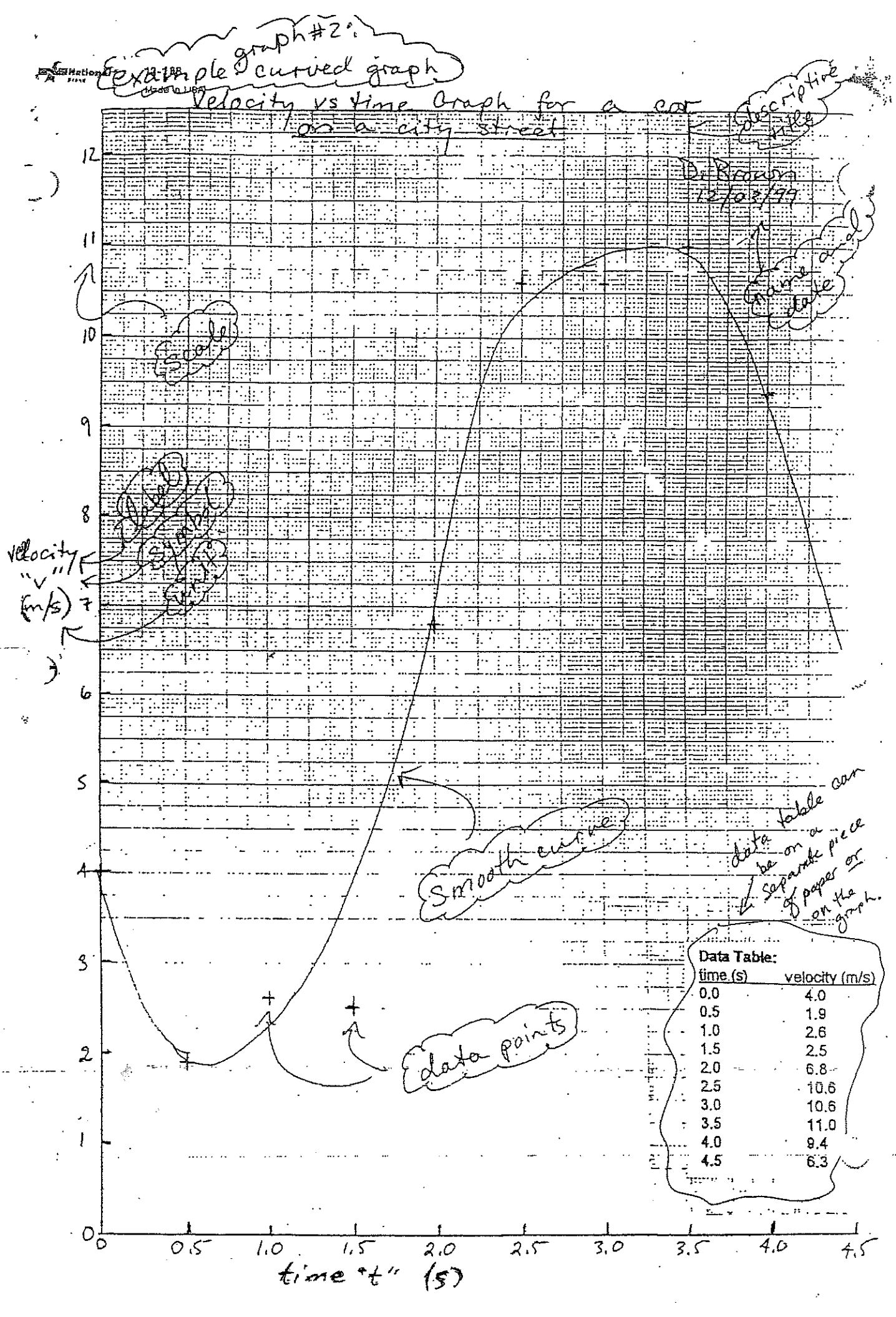
R Smith




graph #2:
Example curved graph
Velocity vs time Graph for a car on a city street
descriptive title
Dr. Brown
12/02/99
name and date
scale
velocity "v" (m/s)
smooth curve
data table can be on a separate piece of paper or on the graph.
data points
Data Table:
time (s) velocity (m/s)
0.0 4.0
0.5 1.9
1.0 2.6
1.5 2.5
2.0 6.8
2.5 10.6
3.0 10.6
3.5 11.0
4.0 9.4
4.5 6.3
0 0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5
time "t" (s)