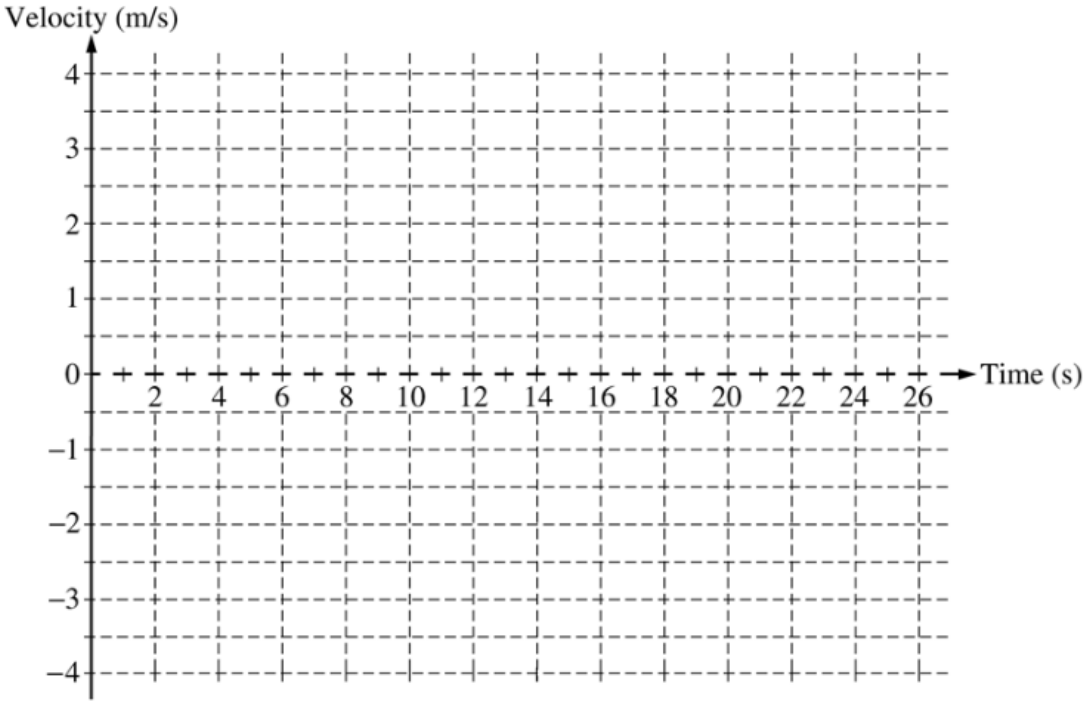
Homework for Chapter 1

1. 2005-physics b-question 1

The vertical position of an elevator as a function of time is shown above.
(a) On the grid below, graph the velocity of the elevator as a function of time.



(b)
i. Calculate the average acceleration for the time period t = 8 s to t = 10 s.

ii. On the box below that represents the elevator, draw a vector to represent the direction of this average acceleration.

(c) Suppose that there is a passenger of mass 70 kg in the elevator. Calculate the apparent weight of the passenger at time t = 4 s.

2. 2006-physics b-question 2

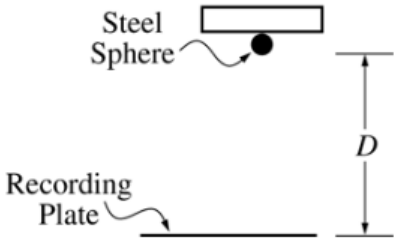
A world-class runner can complete a 100 m dash in about 10 s. Past studies have shown that runners in such a race accelerate uniformly for a time t_u and then run at constant speed for the remainder of the race. A world- class runner is visiting your physics class. You are to develop a procedure that will allow you to determine the uniform acceleration a_u and an approximate value of t_u for the runner in a 100 m dash. By necessity your experiment will be done on a straight track and include your whole class of eleven students.

(a) By checking the line next to each appropriate item in the list below, select the equipment, other than the runner and the track, that your class will need to do the experiment. ____ Stopwatches ____ Tape measures ____ Rulers ____ Masking tape ____ Metersticks ____ Starter's pistol ____ String ____ Chalk

(b) Outline the procedure that you would use to determine a_u and t_u , including a labeled diagram of the experimental setup. Use symbols to identify carefully what measurements you would make and include in your procedure how you would use each piece of the equipment you checked in part (a).

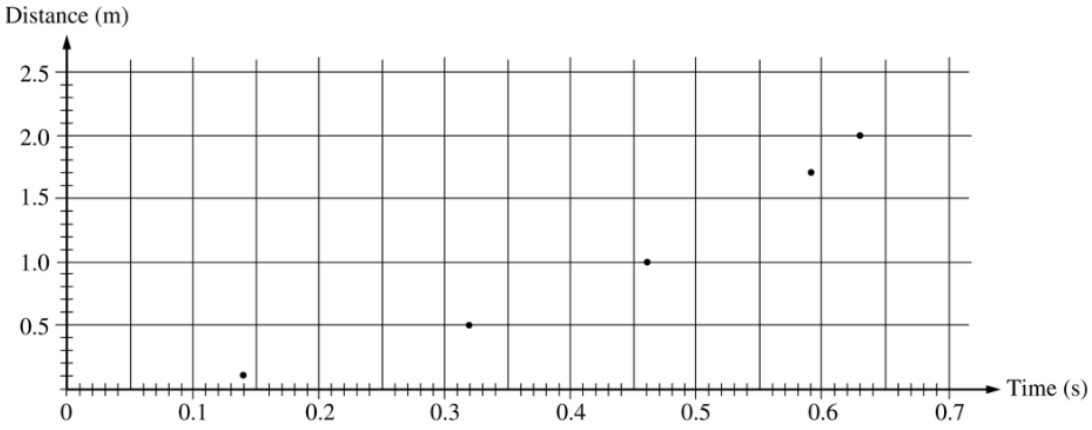
(c) Outline the process of data analysis, including how you will identify the portion of the race that has uniform acceleration, and how you would calculate the uniform acceleration.

3. 2006-physics b-form b-question 1



A student wishing to determine experimentally the acceleration *g* due to gravity has an apparatus that holds a small steel sphere above a recording plate, as shown above. When the sphere is released, a timer automatically begins recording the time of fall. The timer automatically stops when the sphere strikes the recording plate. The student measures the time of fall for different values of the distance *D* shown above and records the data in the table below. These data points are also plotted on the graph.

Distance of Fall (m)	0.10	0.50	1.00	1.70	2.00
Time of Fall (s)	0.14	0.32	0.46	0.59	0.63

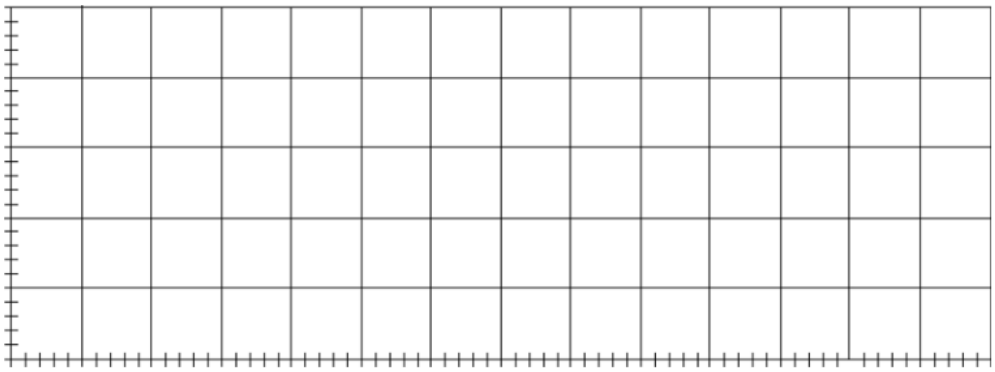


(a) On the grid above, sketch the smooth curve that best represents the student's data.

The student can use these data for distance *D* and time *t* to produce a second graph from which the acceleration *g* due to gravity can be determined.

(b) If only the variables *D* and *t* are used, what quantities should the student graph in order to produce a linear relationship between the two quantities?

(c) On the grid below, plot the data points for the quantities you have identified in part (b), and sketch the best straight-line fit to the points. Label your axes and show the scale that you have chosen for the graph.



(d) Using the slope of your graph in part (c), calculate the acceleration *g* due to gravity in this experiment.

(e) State one way in which the student could improve the accuracy of the results if the experiment were to be performed again. Explain why this would improve the accuracy.