

Engineering Science Worksheets

SIMPLE HARMONIC MOTION KIT ES7

2. SIMPLE PENDULUMS

Name	
Date	
Course/Year/Group	

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Simple Pendulums

Aims

To prove the theory for simple pendulums.

Experiment Setup

As shown in Figure 1, fix the Top Plate to the Work Panel. Count the holes in the Work Panel if you need to make sure everything fits correctly.

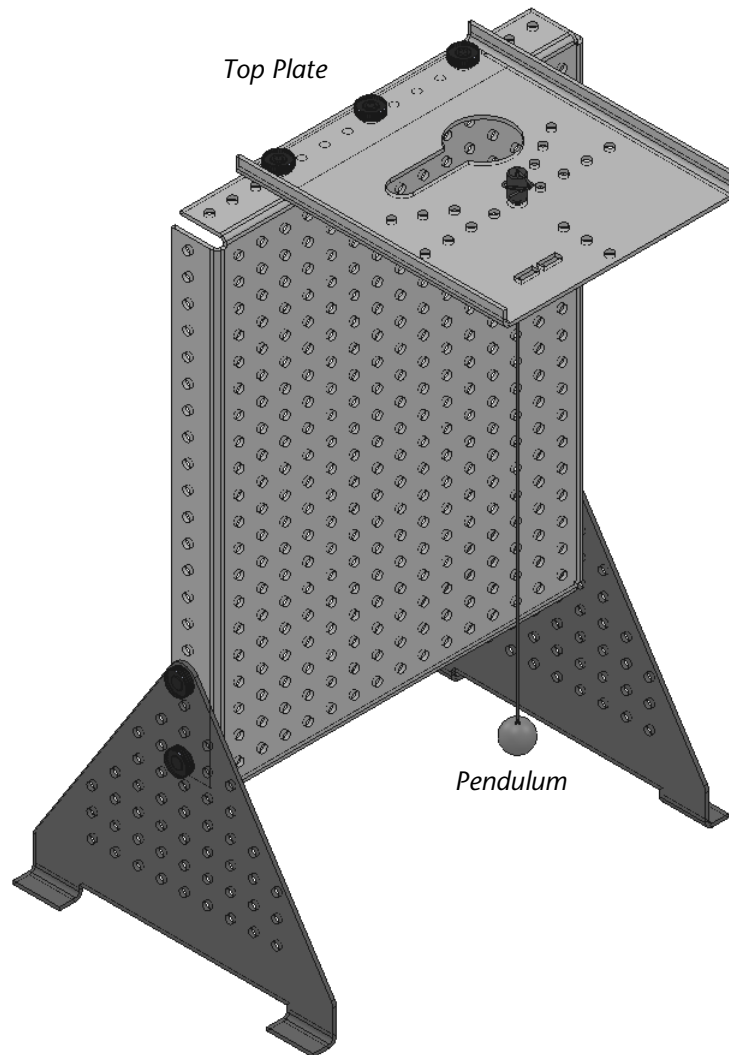


Figure 1 Experiment Setup

Experiment Procedure

1. Read the Guidance Notes (supplied).
2. Feel the difference in weight of the two simple pendulum balls.
3. Choose the lightest and fit it to the Work Panel as shown.
4. Set its length (l) to 500 mm (0.5 m).
5. Push it to one side by roughly 100 mm and release it to allow it to swing freely. It should just swing clear of the supports.
6. Use the stopwatch to measure how many seconds it takes to complete 50 complete swings (from one side to the other and back). Note that its swings will get smaller and smaller, but should always use the same period of time to move from one side to the other.
7. Repeat for lengths of 450 mm, 400 mm, 350 mm, 300 mm, 250 mm and 200 mm.

NOTE



You could try shorter lengths but the pendulum may swing too fast for you to accurately measure the time.

8. For each line of results, divide the time taken by 50 to find the actual period (T).
9. For each line of results, use your actual T to find $\left(\frac{T}{2\pi}\right)^2$.
10. For each line of results calculate $\sqrt{l}$, then using the standard $g = 9.81$, calculate the theoretical period for the lengths you used.
11. Repeat the experiment with the heavier pendulum.

Length (l) (m)	$\sqrt{l}$	Time for 50 swings (seconds)	Actual Period (T)	Theoretical Period $T = 2\pi\sqrt{\frac{l}{g}}$	$\left(\frac{T}{2\pi}\right)^2$
0.5					
0.45					
0.4					
0.35					
0.3					
0.25					
0.2					
Pendulum: Lightest					

Table 1 Blank Results Table

Length (l) (m)	$\sqrt{l}$	Time for 50 swings (seconds)	Actual Period (T)	Theoretical Period $T = 2\pi\sqrt{\frac{l}{g}}$	$\left(\frac{T}{2\pi}\right)^2$
0.5					
0.45					
0.4					
0.35					
0.3					
0.25					
0.2					
Pendulum: Heaviest					

Table 2 Blank Results Table

12. Choose the results from the heaviest pendulum. On the blank chart paper, plot the actual and theoretical values of T against $\sqrt{l}$. Your results should confirm that the period is proportional to the square root of length, rather than just length. Extend your line of results until it crosses the vertical axis of the chart.
13. Again, using the results from the heaviest pendulum, on the other blank chart paper, plot length (l) against $\left(\frac{T}{2\pi}\right)^2$. Find the gradient of the results, which should give an average value for g .

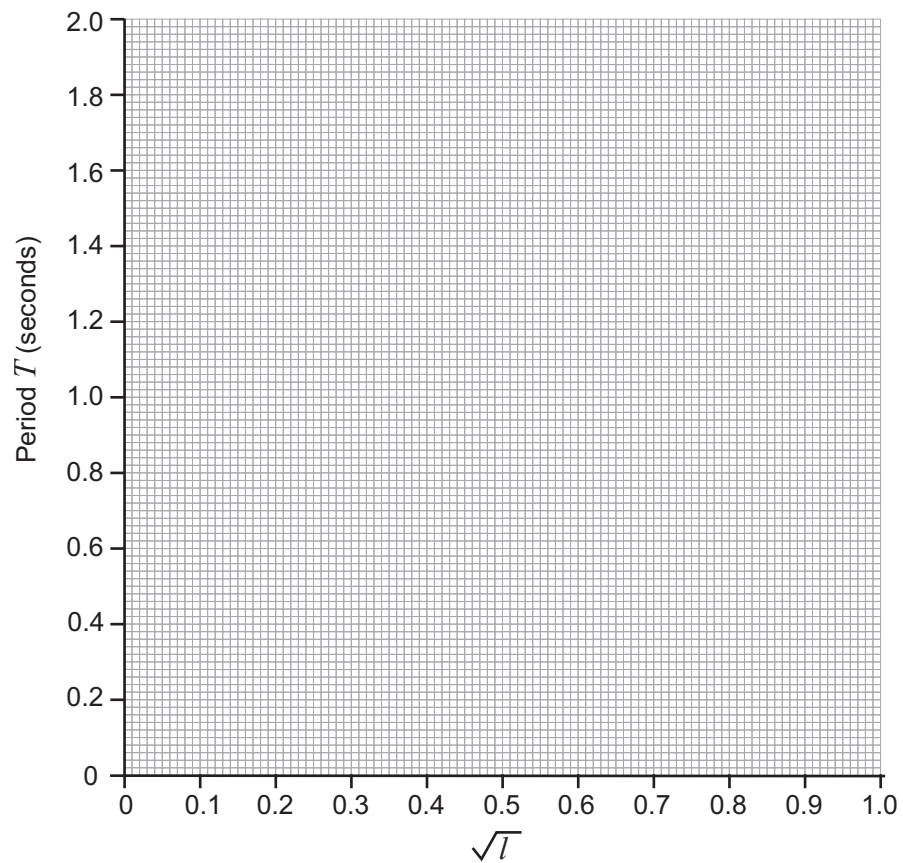


Figure 2 Blank Chart Paper

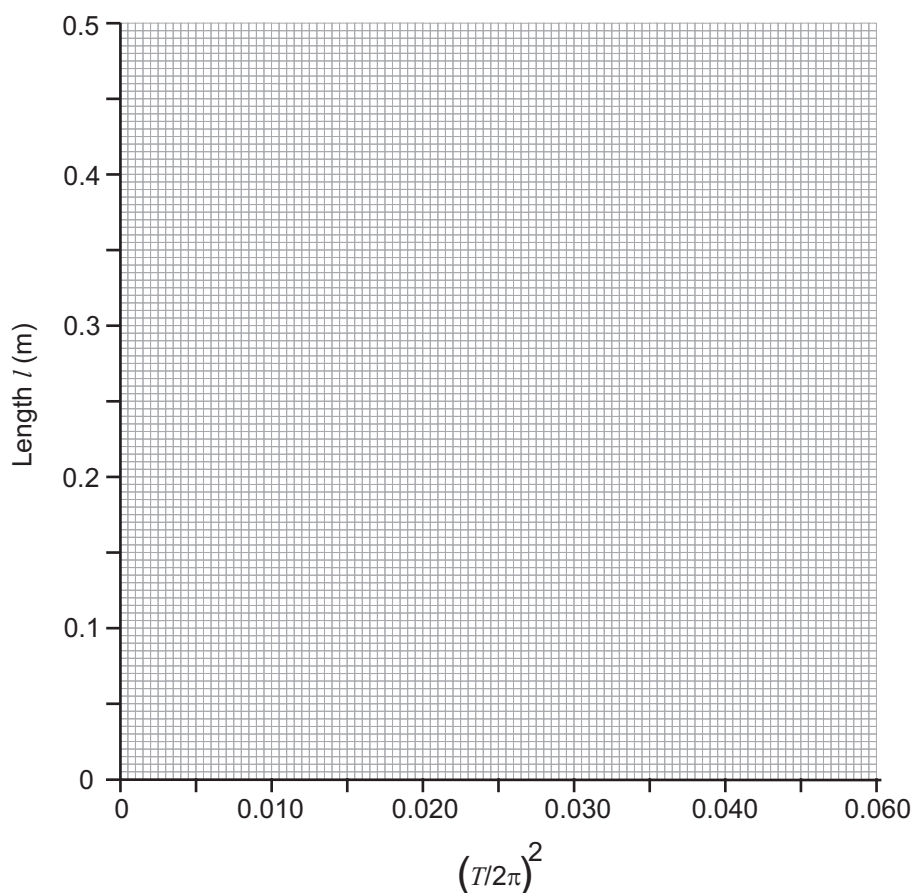


Figure 3 Blank Chart Paper

Questions and Conclusions

As shown in the Guidance Notes, your results for both the lightest and heaviest pendulums should be the same (or very similar), showing that the mass of the ball has no effect on the results for a simple pendulum.

For the period, your actual results should be fairly similar to the theoretical results, but expect bigger differences with the shorter pendulums due to the increased measurement errors of length. These errors will show themselves on your chart of period against $\sqrt{l}$. With no errors, the results should pass through the 0,0 origin. Errors cause the intercept to be above or below 0,0.

Comment on the accuracy of your value of g from the gradient of your second chart, compared to the textbook value of 9.81 m.s^{-1} . Can you explain any errors? Could you make the experiment more accurate?

Notes

[illegible]