POPPY SCHOLARS · PHYSICS OF THE UNIVERSE

Home lab 4 · Unit 4 · about 45 minutes

Can a string and a weight measure the acceleration of gravity, and what does the swing time depend on?

Name _____ Date _____

MATERIALS

You supply everything. Tick each item as you gather it.

- ☐ A string about 1.2 m long
- ☐ A small, dense weight (a few washers, a nut, a lead fishing weight or a ring)
- ☐ A tape measure, a phone stopwatch, and tape
- ☐ A doorway or a shelf edge to hang the pendulum from, graph paper and a calculator

SAFETY

Make sure the support is solid so that the weight cannot fall on anyone. Swing the pendulum where nobody will walk into it, and keep the weight small and light.

PROCEDURE

1. Tie the weight to the string, and fix the other end firmly to a support. Make the length from the support to the center of the weight 1.00 m, and measure it.
2. Pull the weight to the side by a small angle, about 10° (a horizontal displacement of about 17 cm for the 1.00 m string), and release it without pushing.
3. Start the stopwatch as the weight passes through the center, and count 20 full swings (out and back is one swing). Record the total time for 20 swings.
4. Repeat for lengths of 0.75, 0.50 and 0.25 m, keeping the amplitude small each time.
5. Compute the period of each (T = time ÷ 20) and its square.
6. Graph T^2 (vertical) against L (horizontal). The theory says $T^2 = (4\pi^2 \div g)\,L$, so the slope is $4\pi^2 \div g$, and $g = 4\pi^2 \div \text{slope}$.

RECORD YOUR DATA

Length L (m)	Time for 20 swings (s)	Period T (s)	T^2 (s^2)
0.25			
0.50			
0.75			
1.00			

Also write the slope of your graph, g, and your percent error against 9.8 m/s^2.

LAB REPORT

Write a report that gives your table and graph, shows how you found g from the slope, calculates the percent error, and says what the graph shows about how the period depends on length and, from the theory, why it does not depend on the mass of the weight.

Report the numbers you actually got, even when they disagree with the lesson. Write on the lines, or type your report on the website and send it to a teacher there.

Question and hypothesis *State the question in your own words, what you expect to happen, and why you expect it.*

Method *What you changed, what you measured, what you kept the same, and how many trials you ran.*

Observations *Describe what you saw, including anything unexpected. Your data tables are added to the report automatically.*

Calculations *Show each calculation step by step, with units.*

Claim and reasoning *Answer the question using your numbers, then explain why, using the science from the unit.*

Limits and next step *What could have affected your results, and one change you would make next time.*