PERIOD OF A PENDULUM

Length, mass, amplitude, and small-angle oscillations

Name: _____	Period: _____	Date: _____

INVESTIGATION QUESTION **How does pendulum length affect its period, and does the bob's mass matter?**

TIME 30 minutes	SIMULATION BuildPhysics > Period of a pendulum	UNIT 7 Oscillations

Learning targets

- Measure a pendulum's period from multiple complete cycles.
- Test the predicted relationship between period and pendulum length.
- Determine whether bob mass changes the period.

Model before you measure

The preset begins with a 1.0 kg bob released from a small angle. Measure length from the pivot to the bob's center.	$T = 2\pi\sqrt{(L/g)}$ $T^2 = (4\pi^2/g)L$

Important: Use $g = 9.8\ m/s^2$. Time five complete cycles and divide by five to reduce timing uncertainty.

Pre-lab prediction | 4 minutes

1. If pendulum length is quadrupled, by what factor should the period change?

_____

2. Predict whether doubling the bob's mass changes the period.

_____

3. At which location are speed and kinetic energy greatest?

_____

PART A Change pendulum length

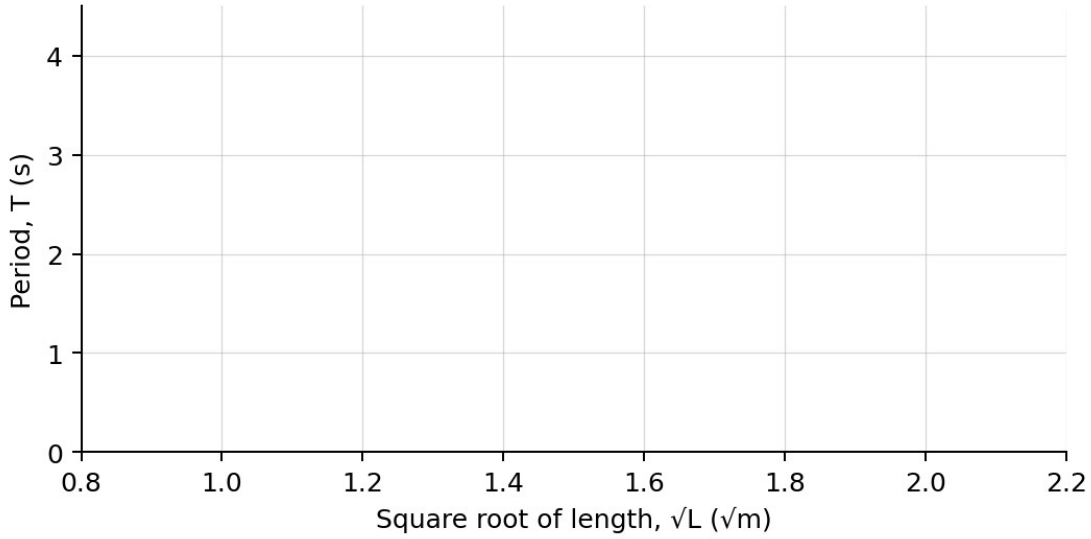
Setup | 3 minutes

- ☐ Load Period of a pendulum. Confirm the release angle is about 15° and the bob begins from rest.
- ☐ Set each pivot-to-center length listed below by adjusting the string length.
- ☐ Keep bob mass and release angle constant.
- ☐ Reset, run five complete cycles, record the total time, and calculate the period T.

Cycle definition: One complete cycle returns the bob to the same side with the same direction of motion.

Data table | 10 minutes

Length L (m)	√L (√m)	Time for 5 cycles (s)	Measured period T (s)	Predicted T (s)	T^2 (s^2)
1.0					
2.0					
3.0					
4.0					



4. Plot measured period T versus √L. Draw a best-fit line.

PART B Change bob mass

Mass test | 7 minutes

Fixed inputs: Use L = 3.0 m and the same small release angle for every mass trial.

Bob mass (kg)	Time for 5 cycles (s)	Measured period T (s)
0.50		
1.00		
2.00		
3.00		

Analysis | 7 minutes

5. What relationship did the T-versus-√L graph show?

6. What should the slope of the graph equal? Use g = 9.8 m/s² to calculate the expected value.

7. How did changing bob mass affect the period?

8. Explain why the bob's speed is greatest at equilibrium and zero at each turning point.

Claim-Evidence-Reasoning conclusion

Evaluate this claim: A heavier pendulum bob swings with a longer period because gravity exerts a larger force.

CLAIM	Accept, reject, or revise the statement.
EVIDENCE	Cite at least two measured trials or graph features.
REASONING	Use the measured mass trials and the period equation to distinguish force magnitude from acceleration.

Exit ticket

A pendulum's length is increased from L to 9L. Predict its new period relative to the original period.