

Name:

Period:

Date:

## KE and PE using the Pendulum Lab

Objective – to develop a visual concept of the relationship between KE and PE during an object's motion. Main Link: <https://phet.colorado.edu/en/simulation/pendulum-lab>

**PART I:** Go to the PHET Pendulum lab and select “Lab”. If you have never used this application before you might want to play around with the “Intro” and “Energy” screens first. On the right, leave Length, Mass, Gravity and Friction alone for now. At the bottom left, turn on the **ruler and the timer**. At the top left, turn on the **Energy Graph**. Play with the pendulum and watch how the KE and PE bars change. Change the starting angle, mass and length of string. One at a time to see how it affects different aspects of the energies and period. You might want to change the speed (lower center) to “Slow”.

1. Make a preliminary statement that describes how these two bars are related to each other and how these relationships change as the pendulum moves through its cycle.

### PART II: PE and KE

At the lower center, turn the speed to “Slow”. At the left, drag the ruler to the KE/PE bar graph. Swing the pendulum so the total Energy Shows. Place ruler so that 5 cm is above the total energy bar. At this point the total should be 55 cm - 5 cm = 50 cm. Remember to subtract that 5 cm each time you take a reading. (Note: this needs to be altered depending upon the length of your energies as you continue through the lab.) **Turn on the velocity. Starting at 90°** (as the pendulum swings), collect data on the height of both KE and PE bars at various locations:

Location Of Pendulum Bob	Kinetic Energy (cm)	Potential Energy (cm)	Questions:
Farthest Right			2. At what point is the PE the greatest?
Bottom Dead Center			3. At what point is the KE the greatest?
Farthest Left			4. At what points is V (velocity) the highest?
Halfway Left			5. What is the relationship between KE and V?

### PART III: Length vs Period

6. **Hypothesis:** How would increasing the length affect the period?

Length Of Pendulum String	Period
.1 m	
.3 m	
.5 m	
.8 m	

#### Questions:

11. What happened to the period as the length of the bob increased?

### PART IV: Mass vs PE,KE, and total Energy

12. **Hypothesis:** How would increasing the mass effect the PE, KE and total energy of the system?

Hit reset and click energy graph, ruler and timer.

Mass of Pendulum Bob	Period (secs)	Kinetic Energy (cm) At bottom	Kinetic Energy (cm) At top	Potential Energy(cm) At Bottom	Potential Energy(cm) At Top	Total Energy (cm)
.15 kg						
.30 kg						
.50 kg						
.80 kg						

13. Was your hypothesis correct? Explain.

14. When the mass increased what other components increased?

15. Try starting at different angles. Fill in the following... As the angle increases the period \_\_\_\_\_.

Angle	Period
45°	
30°	
15°	

16. How can you get the shortest period?

17. Using one of Newton's 3 Laws of Motion, explain why the pendulum continues to move without stopping or slowing down once it is set in motion.

18. What could you do to make the pendulum slow down and eventually come to a stop?

19. How does the change in mass affect the period?

20. Switch to the moon. How does the change in gravity affect the period?