

Pendulum Lab

Spoken Tutorial Project

<http://spoken-tutorial.org>

National Mission on Education through ICT

<http://sakshat.ac.in>

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31 October 2018



Learning Objectives



Learning Objectives

- ▶ Demonstrate Pendulum Lab, PhET simulation



System Requirement



System Requirement

- ▶ **Ubuntu Linux OS v 16.04**



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- ▶ **Java v 1.8.0**



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- ▶ **Ubuntu Linux OS v 16.04**
- ▶ **Java v 1.8.0**
- ▶ **Firefox Web Browser v 62.0.3**



Pre-requisites



Pre-requisites

- ▶ **Learner should be familiar with topics in high school physics**



Learning Goals



Learning Goals

- ▶ Describe simple harmonic motion



Learning Goals

- ▶ Describe simple harmonic motion
- ▶ Demonstrate the oscillations of a pendulum



Learning Goals

- ▶ Describe simple harmonic motion
- ▶ Demonstrate the oscillations of a pendulum
- ▶ Investigate the factors that affect the oscillations of a pendulum



Learning Goals



Learning Goals

- Explain conservation of energy during motion of the pendulum



Learning Goals

- ▶ Explain conservation of energy during motion of the pendulum
- ▶ Demonstrate the oscillations for a pair of pendulums



Learning Goals

- ▶ Explain conservation of energy during motion of the pendulum
- ▶ Demonstrate the oscillations for a pair of pendulums
- ▶ Demonstrate the oscillations of pendulum on other celestial bodies

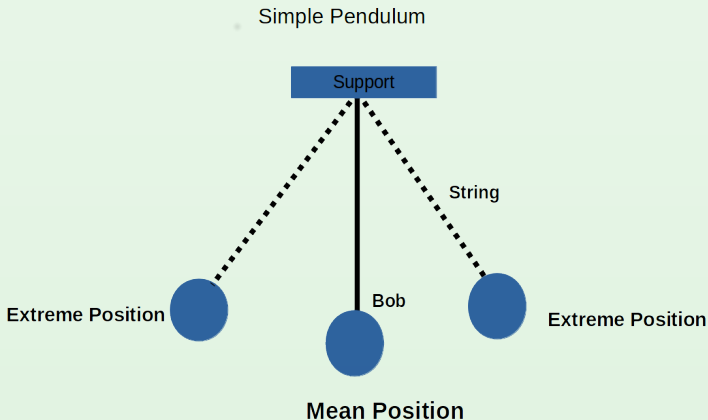


Simple Pendulum



Simple Pendulum

A simple pendulum has a fixed string attached to a bob

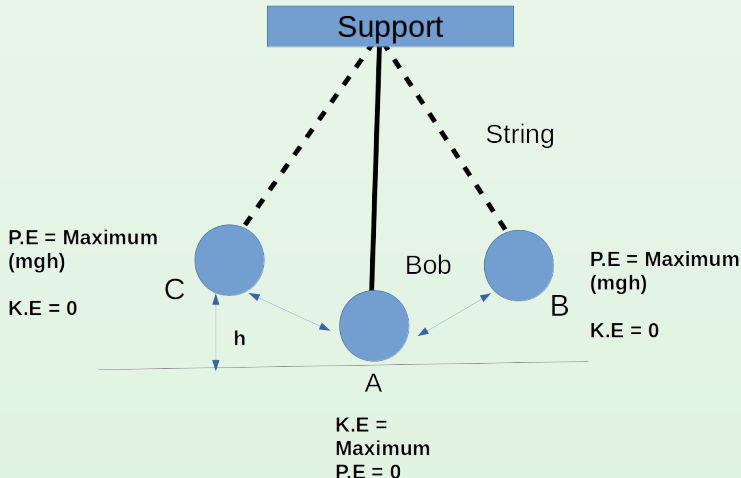


Simple Harmonic Motion

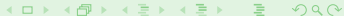


Simple Harmonic Motion

In SHM, $F \propto -x$



PhET Simulation-Link



PhET Simulation-Link

<https://phet.colorado.edu>



Tabular Column



Tabular Column

Table: Time for 10 Oscillations

Length (m)	Time for 10 Oscillations		
	t1 (sec)	t2 (sec)	$t = (t1 + t2)/2$ (sec)
0.70			
0.60			
0.50			
0.40			
0.30			



Tabular Column



Tabular Column

Length (m)	Time for 10 oscillations		
	t1 (sec)	t2 (sec)	$t = (t1 + t2) / 2$ (sec)
0.70	15.35	15.63	15.49
0.60			
0.50			
0.40			
0.30			



Tabular Column



Tabular Column

Length (m)	Time for 10 oscillations		
	t1 (sec)	t2 (sec)	$t = (t1 + t2)/2$ (sec)
0.70	15.35	15.63	15.49
0.60	14.47	14.53	14.50
0.50			
0.40			
0.30			



Assignment



Assignment

- Change the length of the pendulum to 0.50m, 0.40m, and 0.30m



Assignment

- ▶ Change the length of the pendulum to 0.50m, 0.40m, and 0.30m
- ▶ Count for 10 oscillations



Assignment

- ▶ Change the length of the pendulum to 0.50m, 0.40m, and 0.30m
- ▶ Count for 10 oscillations
- ▶ Note down the time



Assignment



Assignment

- Explain why acceleration is maximum at the extreme positions?



Tabular Column



Tabular Column

Table: Calculated and measured Time Period

Length (m)	Time Period (calculated) $T = 2\pi\sqrt{l/g}$	Time Period (measured) T
0.70		
0.60		
0.50		
0.40		
0.30		



Formula for Time Period



Formula for Time Period

- Calculate the time period using the formula

$$T = 2\pi\sqrt{l/g}$$



Formula for Time Period

- ▶ Calculate the time period using the formula

$$T = 2\pi\sqrt{l/g}$$

- ▶ l is the length and g is acceleration due to gravity



Formula for Time Period

- ▶ Calculate the time period using the formula

$$T = 2\pi\sqrt{l/g}$$

- ▶ l is the length and g is acceleration due to gravity
- ▶ Value of $g = 9.81 \text{ m/s}^2$



Tabular Column



Tabular Column

Table: Calculated and measured Time Period

Length (m)	Time Period (calculated) $T=2\pi\sqrt{l/g}$	Time Period (measured) T
0.70	1.71	
0.60	1.55	
0.50		
0.40		
0.30		



Tabular Column



Tabular Column

Table: Calculated and measured Time Period

Length (m)	Time Period (calculated) $T=2\pi\sqrt{l/g}$	Time Period (measured) T
0.70	1.71	1.73
0.60	1.55	1.60
0.50		
0.40		
0.30		



Assignment



Assignment

- ▶ **Change the lengths of the pendulum to 0.50m, 0.40m and 0.30m**



Assignment

- ▶ Change the lengths of the pendulum to 0.50m, 0.40m and 0.30m
- ▶ Note down the measured time period



Assignment



Assignment

- ▶ Calculate the time period using the formula



Assignment

- ▶ Calculate the time period using the formula
- ▶ Compare the calculated and measured time period values



Assignment



Assignment

- **Observe the oscillations on other celestial bodies**



Summary

- ▶ How to use **Pendulum Lab**, PhET simulation



Summary

- ▶ Described simple harmonic motion
- ▶ Demonstrated oscillations of a pendulum
- ▶ Investigated the factors that affect the oscillations of a pendulum



Summary

- ▶ Demonstrated how energy is conserved during oscillations
- ▶ Demonstrated the oscillations of a pair of pendulums
- ▶ Observed the oscillations on other celestial bodies



About the Spoken Tutorial Project

- ▶ Watch the video available at http://spoken-tutorial.org/What_is_a_Spoken_Tutorial
- ▶ It summarises the Spoken Tutorial project



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- ▶ If you do not have good bandwidth, you can download and watch it



Spoken Tutorial Workshops

The Spoken Tutorial Project Team

- ▶ Conducts workshops using spoken tutorials
- ▶ Gives certificates to those who pass an online test
- ▶ For more details, please write to contact@spoken-tutorial.org



Forum for specific questions

- ▶ Do you have questions in **THIS Spoken Tutorial?**
- ▶ Please visit
<http://forums.spoken-tutorial.org>
- ▶ Choose the minute and second where you have the question
- ▶ Explain your question briefly
- ▶ Someone from our team will answer them



Acknowledgements

- ▶ This project is partially funded by
**Pandit Madan Mohan Malaviya
National Mission on Teachers and
Teaching**



Acknowledgements

- ▶ Spoken Tutorial Project is a part of the Talk to a Teacher project
- ▶ It is supported by the National Mission on Education through ICT, MHRD, Government of India
- ▶ More information on this Mission is available at

<http://spoken-tutorial.org/NMEICT-Intro>

