Oscillations and Simple Harmonic Motion

Anderson Gomes, Professor Associado

Born December 2, 1956, Anderson Stevens Leonidas Gomes is a native of Recife, Pernambuco. He holds a Licenciate degree and Masters degree in Physics from the Universidade Federal of Pernambuco, and a PhD in Laser Physics from Imperial College of Science, Technology and Medicine, University of London, and has been a post-doc at Brown University. He has been an Associated Professor of Physics Department of UFPE since 1990. His scientific activities are in the area of Laser applications in nano and biophotonics, nonlinear optics and optics communications, where he is co-author of over 220 scientific papers and supervised more than 30 Master and PhD thesis. He is a fellow of the Optical Society of America, where he has been the Chair of the International Council (2011-2012) and of the Brazilian Physical Society.

In 2010, he was awarded and admitted into the National Order of the Scientific Merit from the Brazilian Presidential Office, Class Comendador in the area of Physical Sciences.

In 2010 he acted as Pernambuco State Secretary of Science, Technology and Environment (April to December, 2010), and was the Secretary of Education of Pernambuco, January 2011 to December 2012, under Governor Eduardo Campos second term leadership. From January to July 2013, he served as one of the Governor Eduardo Campos special Advisors.

While Education Secretary, he was responsible for implementing the most recent programs in technology as a pedagogical tool.

The Universidade Federal of Pernambuco, Pernambuco, Brazil

The Universidade Federal of Pernambuco is among the top 10 Brazilian Universities, and the Physics Department is one of the top eight in Brazil. Located in Recife, capital of Pernambuco, Brazil, the university has over 28,000 undergraduate students in 97 courses 4,000 Master and 2,500 PhD students. The Physics Department will complete 45 years of teaching and research in 2014, and forms Licenciates (for High School Physics Teaching), Bachelors, Masters, and PhD in theoretical and experimental Physics. Its main areas of research are Condensed Matter, Magnetism and Optics, and other groups in Superconductivity, Magnetic Resonance and Nonconventional Polymers are part of the Department. Forming teachers for high schools is one of the most important challenges of the Physics Department.

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Learning Objectives

Students will:

- Learn about harmonic motion and periodic oscillation
- Understand period, frequency and amplitude of the harmonic motion
- Give examples of harmonic motion in the world around us
- Determine mathematically the period of oscillation of a simple pendulum
- Measure the period of oscillation of a simple pendulum
- Determine the acceleration due to gravity from the period of a simple pendulum

Grade Level: High School

Lession Duration: 45 minutes

Materials and Resources:

- JP-IK MG101 A8 – an Intel® classmate PC
- Intel® Education Lab Camera by Intellisense
- Simple pendulum
- Video on harmonic motion
- Calculator (optional)

Background/Context

Today's lesson is about harmonic motion. This is a phenomenon that we can find in nature from the solar system to atoms! Prior to today's lesson, students have learned energy conservation and second Newton's Law. Simple trigonometric relations will be required.

Activity

Engage students by asking them what a person bouncing on the end of a diving board, a child on a swing, a grandfather clock, and a car that has no shocks all have in common? Once students have shared their ideas, they will view a video about harmonic motion and simple pendulum. Following the video, discuss questions from the video. The discussion will lead to a hands-on activity where students will use Lab Camera Software to see harmonic motion with a simple pendulum. They will measure the period of the pendulum, and using the formula derived for the period, the value of g, the acceleration due to gravity will be determined by the students.

All the values obtained by the students should be averaged, and an average value of g with a given error bar should be given. Errors can be discussed.

Assessments:

A quick (5 min) assessment that includes questions will be put up on the screen and the students will answer.

Wrap Up and Reflection

To close the lesson, we shall remind the students of linear motion and harmonic motion that repeat upon themselves, highlighting the main differences. They should be led to reflect on societal and environment impact of harmonic motion and think about other examples that reflect harmonic motion.

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