Conservation of Energy

by Andrew MacKinnon

Experiment Overview

The law of Conservation of energy is proved in this practical where Gravitational Potential Energy is transformed into Kinetic Energy. A metal ball is suspended as a pendulum, as the pendulum swings it is released at the lowest point of the swing where it will only have horizontal motion. By measuring the subsequent vertical and horizontal distances the metal ball travels after the release point the velocity and hence the Kinetic Energy of the ball at the point of release can be determined. The Gravitational Potential Energy that the ball has lost before the release is proportional to the height difference between its initial position and the release point. Hence students are able to determine the decrease in Gravitational Potential Energy which is equal to the Kinetic Energy at the point of release.

Learning Experience

This experiment is used for both Physics I students as well as students doing the service subject Physics Principles and Applications (PPA). Although the practical is of an appropriate level for Physics I students those students completing PPA often find the experiment confusion and daunting, especially as it is the first practical these students complete.

Aims and Objectives

From a physics perspective this experiment aims to show that energy is conserved when it is converted to other forms. From a laboratory perspective is gives students experience dealing with analysing and obtaining accurate measurements this includes: understanding limitations and sources of uncertainty in measurements, the care required to make measurements as repeatable as possible, the need to make multiple measurements to increase precision and accuracy, the concept of varying parameters to fully test an hypothesis, experience graphing data to visually determine relationships.

This experiment coincides with the lecture material covering mechanics which includes conservation of energy.

Level of Experiment

First Year Undergraduate Physics Principles and Applications (PPA) and Physics I students. PPA students have not adequately done any physics and mathematics subjects at Year 12 level.

Keyword Descriptions of the Experiment

Domain
Mechanics, Classical Physics

Specific Descriptors
Conservation of Energy, Gravitational Potential Energy, Kinetic Energy, Projectile Motion, Statistics

Course Context

The Physics Principles and Applications course provides an introduction to some of the principles of physics and their applications in agricultural and biological sciences. It is intended for students who have not studied SACE Stage 2 Physics, and who require familiarity with Physics principles and applications in their other studies. The course introduces concepts of force, energy, thermal physics, fluids and DC electricity. Introduction to practical problem solving.

Prerequisite Knowledge and Skills

Students are required to understand the concepts of Gravitational Potential Energy, Kinetic Energy and Conservation of Energy. Understanding of basic statistical interpretation of data is advantageous but not essential. This is the first in-lab practical the students experience, as such limited practical writing up experience is expected. A pre-practical quiz must be completed before students are allowed to attempt the experiment.

Time Required to Complete

Prior to Lab: 1-2 hours
In Laboratory: 3 hours
After Laboratory: 0

Experiment History

This experiment has been used within the Physics Discipline at the University of Adelaide for over 15 years. Initially it was part of the suite of experiments that Physics I students were required to complete. It was later included into the compulsory experiments for Physics Principles and Applications students (a service course introduced for students with little or not physics background).Whilst the authors listed in section (1.9) are responsible for the educational analysis of this experiment, their submission of it to ASELL is done on behalf of all academic staff

References

Giancoli, D. C. (2005) Physics Principles with Applications, 6th ed. (Prentice Hall).