PHYS 1401 – General Physics I
Laboratory # 13
Determining the Coefficient of Friction

INTRODUCTION

In this experiment we will put together many of the things we have learned this semester and use an experiment to determine a genuinely unknown quantity. The situation, and the problem, is posed as follows:

A pendulum consisting of a ball on a string is held at an angle of 20° and then released. When the ball is at its lowest point, it strikes the side of a cardboard box. The ball keeps going, and starts moving in simple harmonic motion. The box slides along the table, and comes to a stop. What is the coefficient of friction between the table and the box?

To solve this problem, think of the situation as being in multiple phases:

Phase 1: The ball is released and comes down to its lowest point.

Is energy conserved during this time? Why or why not?
If energy is not conserved, can we account for non-conservative forces? If so, how?
Is momentum conserved during this time? Why or why not?

Phase 2: The ball strikes the box

Is energy conserved during this time? Why or why not?
If energy is not conserved, can we account for non-conservative forces? If so, how?
Is momentum conserved during this time? Why or why not?

Phase 3: The ball goes into simple harmonic motion.

Is energy conserved during this time? Why or why not?
If energy is not conserved, can we account for non-conservative forces? If so, how?
Is momentum conserved during this time? Why or why not?

Phase 4: The box slides across the table and comes to a stop.

    Is energy conserved during this time? Why or why not?
    If energy is not conserved, can we account for non-conservative forces?
If so, how?
    Is momentum conserved during this time? Why or why not?

    Thinking about these various phases will help you to construct equations based on conservation of energy and/or momentum. You can then determine what quantities you need to measure in the lab to determine the coefficient of friction. Treat the situation as a homework problem that you must solve, only the numbers are not given. You must acquire the data yourselves. Discuss with your lab mates how to best solve the problem.

    For your lab report, present the diagrams and calculations that you have used to solve the problem, along with a written explanation of how you solved the problem. Include a data table containing the things that you must measure, and the measurements that you took. Do three trials and three separate sets of calculations, and get an average value for the coefficient of friction.