PHYSICS 230 LAB #6 - Launching Tube

The important concept in this lab is "Conservation of Energy" and "Projectile Motion". You learned different types of energy in the lecture. We are going to use that concept in this lab and the next one.

Initial Setting

Notice the storage of launching tubes. The tubes should be facing against the wall. When you put it back, put it back the way it was stored. Study the structure of the launching tube. Some of them are damaged at the bottom part because of past students' carelessness. Use the lip of the launching tube as a guide when you secure it on the table. Use only one C-clamp to do so.

Estimation of energy lost in the tube

Read the manual and follow the direction to estimate the energy lost (into both sound and heat) while the ball is in the tube. However, be careful when you are drawing a diagram. Real potential energy drop needs to be measured from the center of the ball at the beginning to the center of the ball at the end. However, the difference is relative – you can measure the same difference at bottom of the tube. It is not a practical to measure from the floor to the center of the ball in the tube. When you write a procedure, don't forget to mention from where to where you are going to measure and the diagram should reflect that. Also, to be parallel with the next setup, use h_1 and h_3 as initial and final height respectively. The manual writes "the steel ball reaches the end of the tube at h_3 with zero velocity." You can probably understand what it means, but it is not described correctly. Do not copy this (of course, you should not copy any of the manual for that matter.) Calculate % energy lost in the tube instead of actual number – even if you calculate actual number, does it mean anything to you or a reader? Also, remember the sound the ball makes in the tube (to compare it with the sound made when a ball collides with a pendulum in the lab #7. Keep this record separately so that even if you have to turn in the lab report, you have the data!).

Projectile

Raise the tube (10 ~12 cm) and repeat the same procedure. Use h'_1, h'_2, and h'_3 to be parallel but to differentiate from the original measurements. This time, the ball will be ejected from the end of the tube and will land on the floor. The manual writes "with a reasonable velocity", but what is "reasonable"? Do not use an ambiguous word like "reasonable" on your report. Locate where the ball lands and place a piece of white paper and hold the paper down by using scotch-tape. Place carbon paper over the white paper, without taping it, and collect data indicating ranges. There is one more measurement you need to be able to calculate the initial angle.

Calculation

You have to understand where you can apply "Conservation of Energy" and where you can apply "Motion equations". For the conservation of energy, one additional type of energy is the rotational energy because the ball is spinning when it comes out of the tube. Once again, we have not covered rotational motion, rotational energy is given as $\frac{1}{5}mv^2$ (This is interesting that the rotational energy is a fraction of kinetic energy equation – after all, both are moving energy!). Once the ejection speed is calculated using "conservation of energy theory", establish regular motion equations for both X and Y coordinates and the rest is something very familiar to you. Calculate the range and compare it with the average range from the data.

Please do not throw the carbon paper away, but return to the front table.