Ph305 **Lab M08: Bouncing Basketball Lab** **My Name_____**
November 2003 **partner name _____**
Block_____

You will be using the Motion Detector, mounted on the ceiling, to analyze the motion of a bouncing ball.

Start the LoggerPro 3.2 program from the Desktop and open the 'Experiment' named Bounce which is in the experiments/sensors and probes/ motion detector folder.

You will drop the ball under the motion detector from as high as convenient and collect the position vs. time data. This data is displayed as a graph on screen.
You will ignore the first downward path of the ball and begin recording the required data at the first impact of the ball with the floor.

1. Collection and Recording of the raw data.

The goal here: To create and then print out the height vs. time graph with the relevant points on the graph labeled with the time, height, and slope values. See the example provided by the instructor.

First, be certain you have 4 consecutive complete arcs of height vs. time data on the computer generated graph. If you aren't sure, ask the assistant or instructor to have a look at your data. Rescale the graph so that these 4 complete arcs fill the graph area.

You will now use the EXAMINE and TANGENT options under the ANALYZE menu to determine height, time, and velocity values.

You will also use the TEXT ANNOTATION option under the INSERT menu to add the necessary time, height, and slope labels to relevant points on the graph. Make the arrow point to the relevant location on the graph. Move the box to a convenient place that doesn't block the view of the actual graphed data. You can ask for help in maneuvering these arrowed text boxes around the graph.

There are 4 maximum height points (h1, h2, h3, h4) that need to be labeled with the h, t, and slope values.

There are 2 velocity points of interest for <u>each</u> impact. These are the <u>largest</u> negative velocity (ball approaching floor) and the <u>largest</u> positive velocity (ball leaving floor). Carefully find and label each of these points with the h, t, and slope values. Be certain you used the points for the LARGEST velocity values.

Rescale and (re)maneuver the text boxes to make the labeled graph easy to read.

Before going farther, check that your data reasonably represents the graphed motion of the ball.
Do the maximum heights decrease as expected?
Do the minimum heights seem reasonable?
Do the signs and magnitudes of the velocities make sense?

When you believe you have found and labeled all of these VERY IMPORTANT locations on the h vs. t graph with their corresponding h, t, and slope values, you are ready to print the graph. Save the graph to your M drive too.

This printout is a major portion of your lab report!

Analysis of the Data

2. Use the <u>just before</u> and <u>just after</u> velocities for the four impacts to calculate the 'elasticity' of the collision which is defined to be the ratio of the After Speed divided by the Before Speed.

The values you use must be the maximum velocity values!!! Be sure to move the you find the point on the h vs t graph that gives the maximum velocity value for each case.

Velocity before (impact 1) =	Velocity after (impact 1) =	Elasticity (impact 1) = ( ) / ( ) =
Velocity before (impact 2) =	Velocity after (impact 2) =	Elasticity (impact 2) = ( ) / ( ) =
Velocity before (impact 3) =	Velocity after (impact 3) =	Elasticity (impact 3) = ( ) / ( ) =
Velocity before (impact 4) =	Velocity after (impact 4) =	Elasticity (impact 4) = ( ) / ( ) =

What accounts for the speed ratio being less than one?

3. Use the data from the labeled height vs. time graph to predict the velocity that expected just before the impact that follows.

Mass of ball = _____ kg					
Maximum height (h1) =	height just before impact 1 =	Δh (1) =	ΔGPE (1) =	predicted V(impact 1)	Measured V(impact 1)
Maximum height (h2) =	height just before impact 2 =	Δh (2) =		Calculated V(impact 2)	Measured V(impact 2)
Maximum height (h3) =	height just before impact 3 =	Δh (3) =		Calculated V(impact 3)	Measured V(impact 3)
Maximum height (h4) =	height just before impact 4 =	Δh (4) =		Calculated V(impact 4)	Measured V(impact 4)

What physics principle and assumptions did you use to determine the predicted velocity just before impact?

What physics accounts for the difference between the measured and predicted velocities?

4. Determine the change in kinetic energy of the ball during each impact. Also determine the ratio of the total after kinetic energy of the ball and earth system divided by the total before kinetic energy of the ball and earth system. This ratio is a measure of the elasticity of the collision.

Mass of ball = _____ kg					
Velocity before (impact 1) =	KE before (impact 1) =	Velocity after (impact 1) =	KE after (impact 1) =	ΔKE (impact 1) =	Elasticity (impact 1) = ( ) / ( ) =
Velocity before (impact 2) =	KE before (impact 2) =	Velocity after (impact 2) =	KE after (impact 2) =	ΔKE (impact 2) =	Elasticity (impact 2) = ( ) / ( ) =
Velocity before (impact 3) =	KE before (impact 3) =	Velocity after (impact 3) =	KE after (impact 3) =	ΔKE (impact 3) =	Elasticity (impact 3) = ( ) / ( ) =
Velocity before (impact 4) =	KE before (impact 4) =	Velocity after (impact 4) =	KE after (impact 4) =	ΔKE (impact 4) =	Elasticity (impact 4) = ( ) / ( ) =

How do these elasticity values compare to those found earlier in the analysis?

Totally elastic collisions are defined as those where the total kinetic energy of the collision system remains constant. If the kinetic energy of your ball and earth system did not remain constant during the collisions, where did this kinetic energy go? Be specific.