ENERGY OF FALLING BODIES
Experiment 6

INTRODUCTION:

When an object such as a ball falls, it accelerates and acquires ***kinetic energy***, or energy of motion. If it does not reach terminal velocity, it acquires its maximum velocity and therefore its maximum kinetic energy just as it hits the ground. At that point, its motion is stopped and it is compressed. The kinetic energy is momentarily converted ***to potential energy***, or stored energy. This potential energy is then converted back to kinetic energy as the ball bounces back. No ball will return to the exact height from which it was dropped because some of the kinetic energy is converted to other forms of energy, such as heat, when the ball hits the ground. According to the ***principle of conservation of energy***, however, the total amount of energy does not change.

In this experiment you will study the motion of a bouncing ball and demonstrate how the ball demonstrates the law of conservation of energy.

APPARATUS & MATERIALS:

- ? Meterstick
- ? Ping-Pong ball
- ? Tennis ball
- ? Rubber ball

PROCEDURE:

1. Have one member of your group hold the meterstick upright with the zero mark on the floor.

2. Have a second member of your group drop one of the balls from the top of the meterstick (100-cm mark) in such a way that it does not touch the meterstick on the way down.

3. Have a third member of your group note the height of the first bounce. The height of the bounces should be called out and recorded by another member. Continue observing successive bounces and record their heights for a maximum of three bounces. (It may take several trials to get your results, since the balls tend to bounce away from the meterstick).

4. Repeat steps 1-3 with the other balls and record data on the report form.

CALCULATIONS:

1. Calculate the potential energy of each ball initially and after the 1st and 2nd bounces, using the following equation:

$$PE = m\ g\ h$$

> Note: Since mass is measured in **grams** and height in **m**, the units of energy will be in **millijoules** (**mJ**) when the value of 10 $\mathbf{m/s^2}$ is used for gravity.

2. Calculate the energy loss between the initial and 1st bounces, and record as $?\,PE_1$ on the Report Form.

$$?\,PE_1 = PE_{initial} - PE_1$$

3. Similarly, calculate the energy loss between the 1st and 2nd bounces, and record as $?\,PE_2$ on the Report Form.

$$?\,PE_2 = PE_1 - PE_2$$

4. Calculate the percent energy loss after the first bounce using the equation below:

$$\%\ \text{Energy loss} = \frac{?\,PE_1}{PE_{initial}} \times 100$$

5. Calculate the percent energy loss after the second bounce using the equation below:

$$\%\ \text{Energy loss} = \frac{?\,PE_2}{PE_1} \times 100$$

6. For each ball, graph the bounce number (x-axis) vs. the height of the bounce (y-axis). Note the shape of each graph.

Name:____________________

REPORT FORM
Experiment 6

DATA TABLE

Type of ball	*Mass of ball*	*First bounce*	*Second bounce*	*Third bounce*

SUMMARY OF CALCULATIONS

Ball Type			
$PE_{initial}$			
? **PE_1**			
? **PE_2**			
% Energy lost (0-1)			
% Energy lost (1-2)			

CALCULATIONS TABLE

Show complete calculations for one ball below:

Ball type:____________

	Answer	*Show calculations here*
Initial PE of the ball ($PE_{initial}$)		
PE of ball after 1^{st} bounce (PE_1)		
PE of ball after 2^{nd} bounce (PE_2)		
PE loss between initial and 1^{st} bounce (? PE_1)		
PE loss between 1^{st} and 2^{nd} bounce (? PE_2)		
Percent PE loss between initial and 1^{st} bounce		
Percent PE loss between 1^{st} and 2^{nd} bounce		

Name:____________________

QUESTIONS:

1. Which ball retained the greatest percent of its energy on each bounce?

2. What happens to the energy of the ball that is not retained?

3. Explain the shape of the graphs for each ball. Why are they curved rather than a straight line?

4. Based on your calculations for the first 2 bounces, predict what the third bounce should be and compare it to your measurement. Show all your calculations and reasoning.