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**Chapter 6: Work and Energy**

**Bouncing Balls Lab (25 pts)**

**Objective:** Sports engineering is becoming a popular specialty field of study. While some engineers dedicate their research to understanding collisions between balls and bats, others study the effects of a golf ball colliding with the head of a golf club. And, mechanical engineers consider momentum and energy when designing vehicles. Learning how the human body and equipment interacts with the ball during impact or how the human body interacts with the inside of a car during a crash helps engineers design better sports equipment and safer vehicles.

**Learning Objectives**

After this activity, you will be able to:

* Explain how momentum and energy change during a collision.
* Recognize that different surfaces and materials promote different types of collisions.
* Collect data to solve equations.
* Learn that understanding material properties is an important aspect of engineering design

**Hypothesis:** Which combination of ball and surface do you think will produce the most elastic collision? Which combination do you think will produce the most inelastic collision?

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**Materials:**

meter stick, 3 balls of different materials, 3 different surfaces, digital scale

**Procedure:**

1. Determine what physical quantities you need to measure for each ball.
2. Determine the best way to measure how bouncy each ball is.
* Decide what measurements you will take to determine if a ball and surface are very bouncy or not bouncy.
1. How will you determine the differences in momentum and energy for different collisions? What’s important here? Consider the possibility of a percentage.
2. Attach your detailed procedure to this lab.

**Equipment:**

Ball Types:

Ball 1:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ball 2:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Ball 3:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Surface Types:

Surface 1:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Surface 2:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Surface 3:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Equations:**

What physical quantities can you calculate from your measurements? Here are some ideas. **Show one sample calculation for any calculations you plan to use.** Put the rest of your answers in a table. Attach any data and calculations to this lab.

Velocity for a falling object: $v=2g∆y $

Momentum: $p=mv$

Change in Momentum: $∆p= p\_{f}- p\_{i}$ $percent momentum lost= \frac{∆p}{p\_{i}} x 100\%$

Kinetic Energy: $K= \frac{1}{2}mv^{2}$ Gravitational Potential Energy: $U\_{g}=mg∆y$

Internal Energy: $∆U\_{int}= U\_{g initial}- U\_{g final}$

**Conclusions and Further Learning**

1. Were any of the collisions you observed perfectly elastic? How do you know? If any collisions weren’t perfectly elastic, where did the energy go?

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1. Which combinations of materials (bouncy and bouncy, bouncy and hard, etc.) lead to a greater change in momentum? What evidence have you collected that supports your claim?

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1. Based on evidence from this experiment, why is basketball played on a hardwood floor?

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