Conservation of Energy Lab Activity
SPH4C

Purpose: To determine the efficiency of an inclined plane as it is used to accelerate a toy car.

Materials: Wooden board, *Hot Wheels*TM or *Matchbox*TM toy car, stopwatch, metre stick, beam balance

Procedure and Data:

1) Measure the vertical distance from the table to the top of the inclined plane, in metres.

   Vertical distance = h_1 = _____

2) Measure the mass of the toy car, in kg.

   Mass = m = _____

3) Calculate the potential energy the car has when it is at the top of the ramp (include units!):

   E_g (top) = mgh_1 = (_____)(_____)(_____) = _____

   Is this the energy input E_{input} or energy output E_{output}? _____

4) Measure the length of the ramp, in metres.

   Length of the ramp = Δd = _____

5) Place the car at the top of the ramp.

6) Let the cart go at the top of the ramp and, using the stopwatch, time how long in seconds it takes for it to get to the bottom. Repeat this step four more times and calculate your average time.

   Times: _____, _____, _____, _____, _____

   Average Time = _____

7) Since the car started from rest (v_1 = 0), the final speed was twice the average speed:

   Final speed v_2 = $2 v_{av} = 2\left(\dfrac{\Delta d}{\Delta t}\right)$ =

8) Calculate the kinetic energy of the cart at the bottom of the ramp (include units!):

   E_k (bottom) = $\frac{1}{2}mv^2$ = $\frac{1}{2}$(_____)(_____)^2 = _____

   Is this the energy input E_{input} or energy output E_{output}? _____

9) Calculate the efficiency for this process.

$$\text{efficiency} = \frac{E_{output}}{E_{input}} \times 100\% =$$

<u>Discussion</u>:

What happened as the car was rolling down the ramp that resulted in a loss of useful energy?

_____

_____

_____

Explain why it is impossible to achieve an efficiency greater than 100% for such <u>any</u> such system.

_____

_____

_____

Describe one physical change you could make to this system to improve the efficiency.

_____

_____

_____

Reducing the friction between the car and the ramp (e.g., waxing the ramp) would <u>not</u> improve the efficiency. Why?

_____

_____

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