PHYSICS 1011 ~ EXPERIMENT 7
Rotational and Translational Energies

Purpose:
The objective of this experiment is to examine the conversion of gravitational potential energy to different types of energy: translational, rotational, and "internal" kinetic energy.

Procedure:
After collecting the data and filling in the data sheet attached, it is your job to compare the potential and kinetic energies. By using the % of initial energy it is possible to compare the three different experiments outlined in the lab manual.

Analysis Part I: Data

Glider:

Length of object passing through photo gate (glider flag) d= _____(m)

Δh =_____(m)   mass = _____(kg)

t (s)

t_{avg} =

σ_t =

$v = d/t_{avg}$=

Solid cylinder:

Length of object passing through photo gate (cylinder diameter) d= _____(m)

Δh =_____(m)   mass = _____(kg)

t (s)

t_{avg} =

σ_t =

$v = d/t_{avg}$=

Hollow cylinder:

Length of object passing through photo gate (cylinder diameter) d= _____(m)

Δh =_____(m)   mass =_____(kg)

t (s)

t_{avg} =

σ_t =

$v = d/t_{avg}$=

Analysis Part II: Calculations

    I.   **Glider:**

        Potential energy Lost:
U (formula) =

        Translational Kinetic Energy Gained:
K_t (formula) =

        % of initial energy =

        Additional loss of energy due to friction:
$\Delta E = U - K_t =$

        % of initial energy =

    II.   **Solid Cylinder:**

        Potential energy Lost:
U (formula) =

        Translational Kinetic Energy Gained:
K_t (formula) =

        % of initial energy =

        Rotational Kinetic Energy Gained:
K_r (formula) =

        % of initial energy =

        Total Kinetic Energy:
$K_{tot} = K_t + K_r =$

        % of initial energy =

        Additional loss of energy due to friction:
$\Delta E = U - K_{tot} =$

        % of initial energy =

III. **Hollow Cylinder:**

Potential energy Lost:
U (formula) =

Translational Kinetic Energy Gained:
K_t (formula) =

% of initial energy =

Rotational Kinetic Energy Gained:
K_r (formula) =

% of initial energy =

Total Kinetic Energy:
K_{tot}= K_t + K_r =

% of initial energy =

Additional loss of energy due to friction:
$\Delta E = U - K_{tot}$ =

% of initial energy =

Conclusions: (Restate results, statistical data, and sources of error. Use the back of the page for more room.)

Questions:

1. For the glider, are U and K_t equal? *Should* they be equal? If there is a difference between them, what might be the cause of the difference?

2. For the solid cylinder, is there any mechanical energy lost to friction?

3. For the hollow cylinder, is there any mechanical energy lost to friction?

4. For which of the three objects is ΔE the largest? Can you give any hypothesis as to why?

5. Which object showed the most efficient conversion of gravitational potential energy to **translational** kinetic energy? Why?

6. Which object showed the most efficient conversion of gravitational potential energy to **rotational** kinetic energy? Why?

7. Which object showed the least efficient conversion of gravitational potential energy to **tota**l kinetic energy? Why?

8. List some sources of error in the experiment. What types of error are they?

9. Think about the way you calculated the final instantaneous velocity in this experiment. There is a way in which this measurement was "cheating". Can you explain why?

10. Did you **need** to measure the mass of the objects in order to compare their energies? Explain why or why not?

11. For the glider part of the experiment, we used an air track. Why? Suppose you had the glider just sliding down the incline? What would have been different? How might that have affected your energy calculations?