ACCELERATION DUE TO GRAVITY (GALOLELA STYLE)

Name Group Number

Partners Lab Day

OBJECTIVE:

To determine the acceleration due to gravity by applying constant acceleration kinematics.

THEORY:

The acceleration (a), down an incline of length (d), and height difference, (H) between the two ends is:

(1) $a = g(H/d)$

(g) is the constant acceleration due to gravity.

When the track is level, (H) and (a) are zero. The gravitational force and acceleration do not act along the track at all. When (H) = (d), the gravitational force and acceleration are completely along the track and (a) =(g).

Rearranging the equation (1) yields:

(2) $g = (ad)/H$

For an object with an initial velocity of zero and constant acceleration, the distance traveled as a function of time is:

(3) $d = ½(at^2)$

For an object with zero initial velocity and constant acceleration, the velocity as a function of time is:

(4) $v = at$

Rearranging equation (4) yields:

(5) $t = v/a$

Inserting equation (5) into equation (3) and yields:

(6) $d = (v^2)/2a$

Rearranging equation (6) yields:

(7) $a = (v^2)/2d$

The velocity of the center of the glider as it passes through the photo gate is:

(8) $v = L/t$

L is the length of the glider flag. **L = 10.0cm**, (t) is the time it takes the glider flag to pass through the photo gate, and **(d) = 100.0cm** is the distance traveled down the incline.

PROCEDURE:

Warning! Never move the glider on the track without air flow.

1. **Place the single leg of the air track on the center of the fully compressed jack.**

2. Place the center of the glider exactly at the 160.0 cm mark of the air track and place the center of the photo gate exactly at 60.0 cm mark. Thus, the distance traveled down the incline, **(d),** is **100.0cm.**

3. Insert the rectangular flag on top of the glider and adjust the height of the photo gate such that the glider interrupts the beam and freely passes through the gate.

4. Measure exactly the height from the table to the air track edge at the 160.0 cm position (H_1) and 60.0cm position (H_2).

5. Release the glider from rest and record the time through the gate.

6. Increase the height of the jack such that H_1 is exactly 1.5cm higher. Measure and record H_2.

7. Repeat steps 5. and 6. for a total of five experimental runs.

Time (s)	Velocity (cm/s)	Acceleration (cm/s^2)	H_1 (cm)	H_2 (cm)	H (cm)	g (cm/s^2)

Show the work and calculations for the first row of the data table below:

$V = L/t =$

$a = (v^2)/2d =$

$H = H_1 - H_2 =$

$g = (ad)/H =$

Repeat the last experimental run with an additional 200 grams of mass loaded on the glider. This will effectively double the total mass of glider.

Does the velocity or acceleration vary significantly for a different glider mass? Explain your result.

Determine the average value of g from the data table and compare it to the free fall value of $980 cm/s^2$ by calculating the % difference. What is the greatest source of experimental error?