PHYSICS 4AL

EXPERIMENT 2: MEASUREMENT OF G

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DERIVATION OF EQUATION 2.1

We first set the velocity V_1 to be the distance d travelled between the first photogate and the second photogate over time T_1. Similiarly, the velocity V_2 is equal to the distance D over time traveled T_2 between the second photogate and the landing pad.

$$V_1 = \frac{d}{T_1} \qquad \text{and} \qquad V_2 = \frac{D}{T_2}$$

We substitute these velocities into the kintic equation $V = V_o + g(t)$, where $V = V_2$, $V_o = V_1$, and t is equal to the average of the two times, or $t = \frac{T_1+T_2}{2}$.

$$V_2 = V_1 + g\left(\frac{T_1 + T_2}{2}\right)$$

By substituting in the values for V_1 and V_2, we get an equation that only contains the units that Equation 2.1 contained.

$$\frac{D}{T_2} = \frac{d}{T_1} + g\left(\frac{T_1 + T_2}{2}\right)$$

By rearranging the equation so that g is isolated, we end up with Equation 2.1.

$$g = \frac{2}{T_1 + T_2}\left(\frac{D}{T_2} - \frac{d}{T_1}\right), \text{ in terms of m/s}^2$$

PLOTS

DATA TABLES

Trial	Photogate Spacing d(m)	Gap to impact Sensor D(m)	Measured Acceleration g(m/s^2)
1	0.080 ± 0.005	.455 ± 0.005	10 ±
2	0.080 ± 0.005	.540 ± 0.005	10 ±
3	0.080 ± 0.005	.630 ± 0.005	10 ±
4	0.080 ± 0.005	.270 ± 0.005	10 ±
5	0.080 ± 0.005	.720 ± 0.005	10 ±

Trial	Gap to impact sensor D(m)	Uncertainty in measured acceleration g(m/s^2)

CONCLUSION

EXTRA CREDIT

REPORT

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