HW 1.1

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1 Period of Compound and Kater's Pendulums

The period of a simple pendulum is

$$T = 2\pi\sqrt{\frac{L}{g}}, \tag{1}$$

where T is the period, L is the length of the pendulum, and g is gravitational acceleration.

A compound pendulum is a suspended rigid body whose center of mass does not pass through the axis of rotation.

The moment of inertia, I, can be found using the parallel axis theorem, given by the equation

$$I = I_{cm} + md^2, \tag{2}$$

where I_{cm} is the moment of inertia about the center of mass, m is the mass, and d is the distance between the pendulum's axis and the new, parallel axis.

$$g = \frac{8\pi^2(l_1 + l_2)}{(T_1^2 + T_2^2)} \tag{3}$$

2 Center of Oscillation, Pivot Points, Radius of Gyration

3 Measurement of g

$$g_{experimental} = 9.799051192049667 m/s^2 \tag{4}$$

Measured Quantity	Value
T_1	1.95832 ± 0.00008 s
T_2	1.95679 ± 0.00006 s
ΔT	0.0015 ± 0.0001 s
l_1	0.375 m
l_{total}	37.306 ± 0.001 in $= 0.9476 \pm 0.0003$ m
l_2	0.5725978 cm

Table 1: Measured Quantities

$$g_{accepted} = 9.80665 m/s^2 \tag{5}$$

$$PecentAccuracy = 100 - \frac{g_{experimental}}{g_{accepted}} * 100 = 100 - \frac{9.799051192049667}{9.80665} * 100 = \tag{6}$$

4 Code

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l_1 = 37.5/100;
l_2 = 0.9475978-l_1;
T_1 = 1.958324696;
T_2 = 1.956786207;


a = 8*pi^2;
la = l_1 + l_2;
lm = l_1 - l_2;
Ta = T_1^2 + T_2^2;
Tm = T_1^2 - T_2^2;

g_experimental = a*((Ta/la)+(Tm/lm))^(-1);

g_accepted = 9.80665;

accuracy = 100-(g_experimental/g_accepted)*100
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