Question

What is the relationship between the angle a constant weight is resting on and a hanging weight to keep the constant weight still?

Hypothesis

If the angle of the incline increases, the mass of the hanging weight must also increase to keep the two objects at rest.

Design

- A string connects a hanging mass to another mass that is on a frictionless incline (Figure 1).
- IDV: Angle of the ramp - measured using a protractor (Table 1)
- DV: Mass of the hanging weight needed to keep both sides at rest - measured by adding washers to the hanging weight until both sides are at rest (Table 1)
- The sine of the angle was graphed vs. the hanging weight needed to keep both sides at rest (Figure 3)
- This was done to verify that the slope of the graph is equal to the mass of the object on the ramp. Positive motion is defined as the hanging weight falling.
- m_2 is a constant weight of 300g

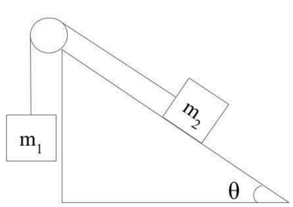

Figure 1: Setup of the system

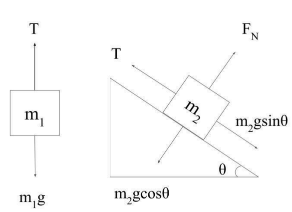

Figure 2: Free-body diagrams for each weight

Table 1: Mass of m_1 vs sine of incline angle

θ (Degrees)	*sin*θ	Mass m_1 (g)
34	0.5591929	168
35	0.5735764	172
40	0.6427876	185
50	0.7660444	230
60	0.8660254	260

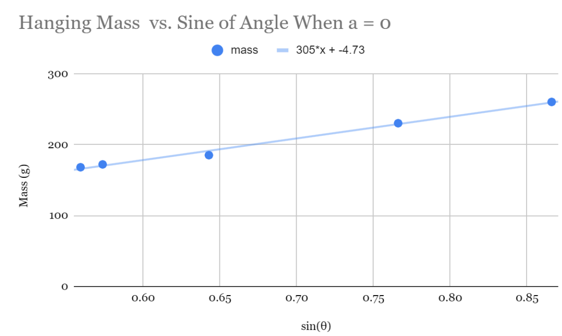

Figure 3: Graph of sine of the measure angle vs the measured mass

Analysis

The free-body diagrams (Figure 2) show the forces acting upon each component. From the free diagrams, the following equations can be derived:

$$T = m_1 g$$
$$T = m_2 g sin\theta$$
$$m_1 g = m_2 g sin\theta$$
$$m_1 = 300 sin\theta$$

This equation indicates that there is a linear relationship between the sine of the angle and the weight needed to keep the two masses at rest. The slope of the graph, being 305g (Figure 3), shows the mass of the object on the incline. The actual mass is 300g, meaning that the experimental data is 1.67% greater than expected; this could be because of friction, which would result in a larger hanging weight.