Question: Does the coefficient of friction between two surfaces vary as a result of adding weight onto a dragged object?
Hypothesis: The coefficient of friction between two surfaces will not vary with the surface area of the object; the coefficient will remain constant even as the normal force chang

Strategy:

- Pulled the block at constant velocity, using vernier to measure pulling force
- Added objects like washers and rocks on top of the block to change the weight and pulled each block at the same angle five times to collect the necessary data to find the different pulling forces
- Created a free body diagram and manipulated the F_{net}=ma equation to determine the relationship between the x component of the pulling force and the normal force
- The equation was graphed through excel to confirm that the slope was equivalent to μ

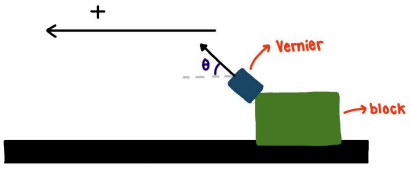

Fig 1: Dragging the block attached to the vernier

Data:

object(s)	mass (g)	average Fn (N)	avg Fpull
block + one washer	130.5	1.091	0.389
block + one rock	177.3	1.478	0.537
block + 2 rocks	255.8	2.022	1.002
block	118.5	1.036	0.258

Table 1: Experimental Data over five trials, pulled at constant angle of 28.9 degrees for every trial

Analysis:

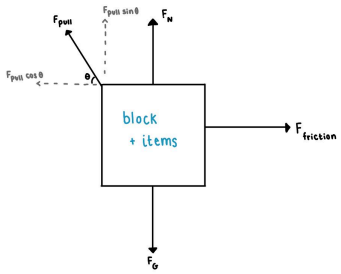

Fig 2: Free body diagram showing all the forces acting on the block

A manipulated version of F_{Net}=ma was used to find the normal force, using information from the free body diagram:

(1) $F_{Pull}\cos(\Theta)-F_F=ma$

(2) $F_{Pull}\cos(\Theta)-\mu(F_N)=ma$

(3) $F_{Pull}\cos(\Theta)-\mu(F_{Pull}\sin(\Theta))=ma$

In this situation, as acceleration was zero, the final equation to solve for normal force was rewritten as:

$F_{Pull}\cos(\Theta)=\mu(F_{Pull}\sin(\Theta))$

From this equation, it is shown how $F_{Pull}\cos(\Theta)$ (x-component of the pulling force) and $F_{Pull}\sin(\Theta)$ share a linear relationship. Therefore, the slope of this line should be equivalent to μ (coefficient of friction between the two surfaces).

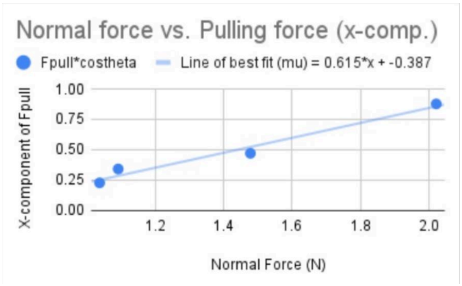

Fig 3: Data modeled by graph

This graphed showcased a <u>mostly linear</u> relationship between the collected data, with a slope of 0.615, once again confirming the hypothesis that the weight of the object would not affect μ between the surface of the block and the wooden plank..

Potential Source of Error:

One potential source of error would be pulling the block at the same angle each time. It might have varied by a little which may have impacted the accuracy of the data.