Question: How can acceleration of an elevator be found using apparent weight at a given moment, along with Newton's second law?

Hypothesis: The acceleration of an elevator can be found with Newton's law and apparent weight in an elevator, and acceleration will be equal to the apparent weight divided by mass.

Strategy:

- A rock with a predefined mass was placed on a scale in an elevator. The scale was filmed while the elevator moved down from the third floor to the first floor.
- The apparent weight (g) on the footage was looked over and recorded every other second due to the length of the video. The most significant data points (when the rock's weights were at their maximum and minimum) were then recorded.
- The acceleration at these points were found by dividing the total force (apparent weight) by the mass of the rock. The maximum and minimum accelerations were then compared to determine if these accelerations were consistent throughout the different trials.

Data:

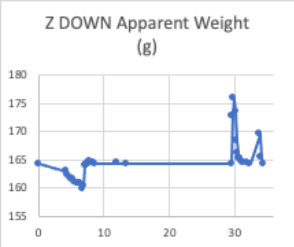

Figure 1: Apparent Weight (g) vs. Time for Rock Z

	Initial	Minimum	Maximum
Z	164.3 g	159.8 g	175.8 g
Dwayne	123.1 g	119.5 g	132.3 g
BAROCK	69.3 g	67.4 g	75.0 g

Table 1: Mass of each rock, and minimum and maximum apparent weights

Analysis:

	Min(m/s^2)	Max(m/s^2)
Z	-0.2684	0.6859
Dwayne	-0.2866	0.7324
Barock	-0.2687	0.8061

Table 2: Accelerations

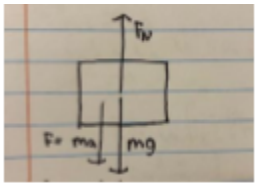

Figure 2: Free Body Diagram

Acceleration was found using the mass and apparent weight measurements. The equation Fn-mg=ma was derived from the free body diagram in Figure 2, which represents the forces acting on the rock. The normal force was calculated by multiplying the mass of each rock in kg and multiplying by gravity (9.8) to get the force in Newtons. We solved for acceleration using the previously defined equation. Table 2 displays the corresponding accelerations for the maximum and minimum apparent weight of each rock. The acceleration of each rock was the same as the acceleration of the elevator because the rock was moved by the elevator, therefore at the same speed and acceleration. The experimental value was calculated by averaging the three different minimum values, and the three different maximum accelerations to create an expected average. Percent error was calculated using the equation (experimental value-actual value)/actual value. The greatest percent error for the minimum acceleration was 4.37%, and 8.71% for the maximum acceleration. This error was caused by discrepancies with the elevator itself, and movements in the elevator by humans, skewing the data.