***Question**: Does the **battery-operated car** move at constant speed or does it accelerate? If it moves at constant speed, what is its speed? If it accelerates, what is its acceleration?*

Claim

The battery-operated car moves at a constant velocity of 0.4293m/s.

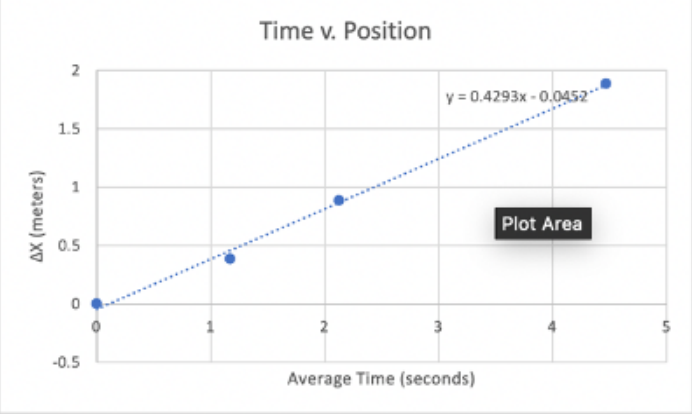
Evidence

Averaged Data			
Distance (m)	Car Length (m)	Average T (s)	Δx (m)
2	0.115	4.47	1.885
1	0.115	2.13	0.885
0.5	0.115	1.17	0.385
0	0.115	0	0

This table includes averaged data of four different distances. Each distance, with the exception of 0m, had three trials and the average time it took for the car to move that distance was calculated. Additionally, the length of the car was considered when calculating the displacement of the car in each trial.

Reasoning

Using the table created, which includes four distances traveled by the car and the average amount of time the car traveled for each distance, a graph was created that related time in seconds to distance traveled in meters.



After creating the graph, a trendline was added to show the best relationship between the four points. It was found that a linear trend line was the best fit. In a time v. position graph, velocity is represented as the slope of the graph and since the graph can be represented using a straight line, the slope is constant; therefore, the velocity is constant as well. In this case, the slope of the graph is 0.4293 which means that the velocity of the car is 0.4293m/s. Additionally, since the velocity is constant, there is no acceleration.

***Question**: Does the **cart** move at constant speed or does it accelerate as it travels down the inclined track? If it moves at constant speed, what is its speed? If it accelerates, what is its acceleration?*

Claim

The cart accelerates as it travels down the inclined track with an acceleration of 0.4942m/s^2.

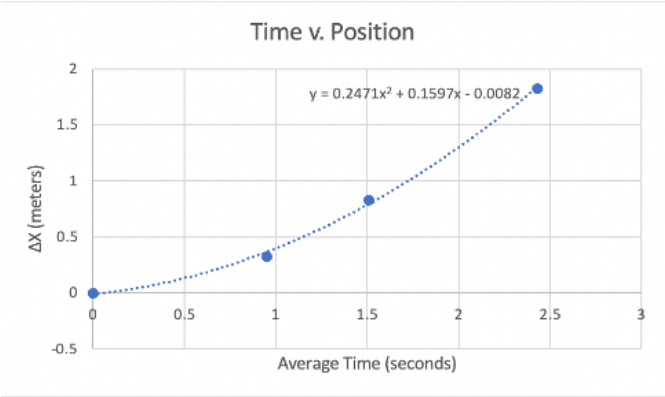
Evidence

Averaged Data			
Total Distance (m)	Cart Length (m)	Average T (s)	Δx (m)
2	0.17	2.43	1.83
1	0.17	1.51	0.83
0.5	0.17	0.95	0.33
0	0.17	0	0

This table includes averaged data of four different distances. Each distance, with the exception of 0m, had three trials and the average time it took for the cart to move that distance was calculated. Additionally, the length of the cart was considered when calculating the displacement of the car in each trial.

Reasoning

Using the table created, which includes four distances traveled by the cart and the average amount of time the cart traveled for each distance, a graph was created that related time in seconds to distance traveled in meters.



After the graph was created, a trendline was added to show the best relationship between the four points. In this case, the trendline was a polynomial with a degree of two. Due to a quadratic trendline, it is shown that the cart's velocity increases over time therefore the cart must be accelerating. When the equation of the trendline is compared to the known equation $x=x_0+v_0t+at^2$, which relates time and distance, the part of the trendline equation $0.2471x^2$ would equal at^2; therefore, $0.2471=a$ and $a=0.4942$. In summary, using the trendline, it was found that the acceleration of the cart is $0.4942 m/s^2$.