Air Drag vs. Area

Abstract:

In this experiment student tried to find out the correlation between the surface area of a sail and the efficiency of the air drag. The result showed that the time it took for a cart traveling 200cm decreases when the surface area of the sail decreases, while the acceleration of the cart is held constant.

Introduction:

The equation of air drag or any kind of drag force is D=cd\*A. Where cd stands for the coefficient of the drag force, and A stands for the reference area. Therefore the drag value should be direct proportional to the reference area, which means the drag force value increase when the area increases, if the drag force increases, the force should have pushed back the cart, in order to slow it down.

Procedure:

1. A 250 cm frictionless track, a lab cart, two rulers, tapes, and a 55.8cm by 77.1cm white cardboard are required for the experiment.
2. Attach the white cardboard to the back of the lab cart with rulers and tapes.
3. Students need to record the time it takes for the cart to travel from the top of the tiled frictionless track to the bottom of the track.
4. Students need to repeat the procedure when the cardboard is being trumped down by 1.5 cm for 24 times.

Experimental design:

Control of Variables:

The area of the white cardboard is the independent variable, while the time of the lab cart travels the track acting as the dependent variable. This assumption is based on the equation

D=cd\*A.

Adapting method changes:

Students have found out that the data changed multiple times throughout the experiment. Multiple spikes of changes presented, therefore student smoother the contact friction between the carwheels of the car and the track.

Minimization of uncertainty:

Uncertainty is between 0.2 second to 0.25 second, because the students were using the hand held stop watch, therefore the human reaction time is calculated in the uncertainty.

Analysis:

Uncertainty: + or – 0.25 seconds

Conclusion:

Student have concluded that the air drag force increase as the reference area increases, the drag force can be calculated with the equation D=cd\*A, where everything in this equation held constant except the reference area, so if the air drag force increases, the amount of pushing the cart backward force also increase, therefore the cart slows down.

Discussion:

In the this experiment, the air drag force would have a impact on the travelling time of the cart, if the friction and the smootherness of the cart’s wheels are negligible; However, in this experiment, the smootherness of the cart’s wheels has made an impact of the travelling time, which direct slows the cart down. Therefore, a smoother cart is recommended in the future similar experiment.