CALIFORNIA STATE SCIENCE FAIR
2011 PROJECT SUMMARY

Name(s)
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Project Number
31759

Project Title
Friction: Can You Beat It?

Abstract

Objectives/Goals
The objective of the project was to determine what method of limiting friction was both most efficient and cost effective. My hypothesis was that the electromagnetic repulsion track would provide both the greatest efficiency and the least cost for its performance.

Methods/Materials
Using a homemade, spring-loaded launcher I propelled a cart over 1 meter of track, timing how long it took to cross the meter using photogate timers. I used an air track, a simple wood track, ferromagnets, and electromagnets with a variable power supply to create four different tracks to test four methods of reducing friction. Using the times, I calculated the average velocities of the cart and was able to use the Law of the Conservation of Energy to approximately calculate the conversion of mechanical energy into thermal energy, which I then used to approximate the friction of each track.

Results
The wheel group (control) had both the second lowest velocity and second highest friction, but the lowest cost. Also, the air track had the fastest times, but the highest costs due to the cost of the specialized track and the needed air supply. In addition, the magnetic track using ferromagnetic materials had the second fastest times and the second lowest cost. Lastly, I found that the Electromagnetic track had the worst times and the second highest costs.

Conclusions/Discussion
My hypothesis of the electromagnet track being the best was incorrect. The air track had the least amount of friction with the air repulsion to levitate the car but the highest cost, while the magnetic tracks and the control group that used wheels had higher friction but the lower costs. The Ferromagnets had the best cost/mechanical energy efficiency balance based on this test, but further testing and testing on larger scales would be needed to check that ferromagnets would be the best in light of other conditions.

Summary Statement
The point of this project was to find the most efficient way to limit the effects of friction on the mechanical energy of a system.

Help Received
My father helped with the construction of components for my project in the use of power tools; my high school allowed me to borrow air track equipment, photogate timers, and a multimeter; my father's cousin allowed me to borrow his variable power supply.