CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY

Name(s)

Alexander Woodside

Project Number

34064

Project Title

How Temperature Impacts Lego Pneumatics

Abstract

Objectives/Goals

The purpose of my project was to confirm in cold temperatures the Lego Pneumatic system would lift and push more weight using less pressure per square inch (PSI).

Methods/Materials

First, I started to create a lift and push Lego Pneumatic system. After a few different models, I finally had the equipment to test my theory. Next, I would lift and push 1 1/4 LB, 2 1/2 LB, 5 LB, and 6 LB with the equipment within every 5° F interval from 15-80° F. I started the lift or push with 30 psi and 40 psi in the system. After the push or lift, I recorded the amount of PSI used to complete the push or lift.

Results

I found cold air was denser than warm air using an air density calculator application. The test results prove the opposite of my hypothesis; less PSI was used in warm air than cold air. I believe cold air used more PSI because the air molecules were more tightly packed. In cold air, molecules move slowly and are closer together. In warm air, molecules move fast and are further apart. Since they are further apart they take up more space. When the warm air is pumped into the system, the molecules collide more creating more pressure. When cold air is pumped into the system, more molecules are needed to reach the same PSI as the warm air. So when the warm air was used, the molecules opened the cylinder quickly. The slower cold molecules opened the cylinder slowly, requiring more PSI. This data explains why my hypothesis was not reinforced.

Conclusions/Discussion

Unfortunately after 56 trials for each mechanism, my project results do not support my hypothesis. Even though my project did not prove my hypothesis, I learned a lot. I learned how pneumatics work, how to construct Lego compressors with the pneumatics, how to use air for a purpose other than breathing, and how air density can affect pneumatic systems. I feel my project was a success even without proving my hypothesis

Summary Statement

In this project, a Lego Pneumatic system was developed to confirm less PSI would be used when operating the system in cold temperatures.

Help Received

I would like to thank Mountain Oaks School for allowing me to borrow the Lego Pneumatic kits. I would also like to thank my mom for advice on my board and my dad for setting up a testing environment.

Preliminary