



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Brian M. Ng	Project Number J1820
Project Title The Effect of Temperature on the Strength of Nitinol Spring	
Objectives/Goals To determine if nitinol spring contracts and exerts different amount of force with the change in temperature	
Abstract Methods/Materials In order to determine if nitinol spring exerts different amount of force with the change in temperature, I conducted a series of experiment where I added different weights, 2 to 18 grams, to the nitinol spring and heated the nitinol to 45 degrees C. I then let the nitinol cooled and measured its length every 5 degrees C until it reaches 15 degrees C. I repeated the experiment three times for each weight and took the average. Then I graphed the results in length versus weight and length versus temperature. For the control group, I conducted an additional experiment on the nitinol without weights. It was used to compare the difference in length when the nitinol was not loaded. The independent variable was the nitinol temperature and the dependent variables were the length and force exerted by the nitinol.	
Results The results showed that the nitinol spring became stronger at higher temperature. In fact, when nitinol was heated from 15 degrees C to 45 degrees C, it became about 3 times stronger. I also discovered that at around 30 degrees C, the nitinol contracted the most. This is the transition temperature where the nitinol changes from martensite to austenite phase.	
Conclusions/Discussion In my research, I discovered that the transition temperature for the nitinol spring is around 30 degrees C and the nitinol becomes 3 times stronger above the transition temperature. This property makes nitinol very useful for many applications where heat is a natural energy source. One example is in medical devices such as a stent made of nitinol which will exert higher force when it is inserted into the blood vessel. Another example is to replace motors to save energy. One of my ideas is to use nitinol in an automatic shading system that is powered by the sun's heat. When the room gets hot, the nitinol will contract and therefore closing the blinds	
Summary Statement Nitinol spring was found to exert 3 times more force at higher temperature and the transition temperature is around 30 degrees C	
Help Received My mother helped me to buy the materials and handle hot water which was used to heat the Nitinol	