



**CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY**

Name(s) William P. Edwards	Project Number J1708
Project Title Archimedes' Golden Crown Principle: Could It Have Worked?	
Abstract Objectives/Goals I tested to see if Archimedes could have used his golden crown principle to determine if King Heiro's crown was all gold or if the smith had substituted some silver in place of the gold. I hypothesized that I would be able to see a difference in the volume of the crown as more and more gold was replaced with silver. Methods/Materials To test my hypothesis, I needed to find two surrogate metals with close to the same density ratio as gold and silver. I found titanium and aluminum has a similar density ratio. The largest known golden wreath crown in Archimedes' time was about 700 grams. This crown would have had a volume similar to a crown of 200 grams of titanium. Because of this, I made my baseline test crown with 200 grams of titanium. To test my hypothesis I decided to do test cases in five percent increments up to 50% of the titanium being replaced with aluminum. To create the five percent increments, I cut my titanium into ten, ten gram pieces and a single 100 gram piece and I cut my aluminum into ten, ten gram pieces. For my tests, I used an overflow vessel (a bucket with a single spout near the top) to measure volume of the crown. First I measured and recorded the volume of all of the titanium pieces (100% titanium case). Then I took out one ten gram titanium piece and replaced it with an aluminum piece. I continued to replace one titanium piece with one aluminum piece until I had all of my aluminum pieces and my 100 gram titanium piece in the overflow vessel. I repeated this until I had ten trials of each of my five percent increments. Results I took a median of my recorded volumes. Based off of this, I was able to see a difference in the volume of the crown with only 10% of titanium replaced with aluminum. Conclusions/Discussion My hypothesis was correct. As more aluminum was substituted for titanium there was a noticeable difference in the crown's volume.	
Summary Statement In my project, I tested to see if Archimedes could have used water displacement to determine if the king's golden crown had some gold replaced with silver.	
Help Received My dad helped me obtain and prepare my test samples. He also helped me layout my display board.	