



# CALIFORNIA STATE SCIENCE FAIR 2011 PROJECT SUMMARY

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| <b>Name(s)</b><br><b>Grant King; Sarah Lamp; Matt Rhodes</b>   | <b>Project Number</b><br><b>S0611</b> |
| <b>Project Title</b><br><b>Determining the Presence and Quantity of Caffeine in Coca Cola Beverages</b>  |                                       |
| <p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b><br/>This project tested the Coca-Cola product line in order to confirm the company's claimed caffeine levels. Our null hypotheses held that the caffeine content in each of the five beverages was the same as that claimed by the Coca-Cola Company. Our alternative hypotheses held that the caffeine content for each beverage was different from what the company claimed.</p> <p><b>Methods/Materials</b><br/>We tested five major products (Coke Classic, Diet Coke, Cherry Coke, and Caffeine-Free Coke) to confirm their caffeine contents. The analysis was performed using High Performance Liquid Chromatography. We created a caffeine calibration curve by running a set of five known caffeine concentrations. We then tested our five products with a number of different samples, and ran each sample through the machine twice. We used methanol water as our control group to confirm the machine was running properly. After averaging our results, we compared them to the calibration curve in order to determine the caffeine levels in the various beverages.</p> <p><b>Results</b><br/>As expected, Caffeine-Free Coke and the methanol water were both free of any caffeine. Of all the tested beverages, Diet Coke had the most caffeine with approximately 46 mg per 12 ounces, while the other three were in the 33-34 mg per 12 ounces range. Both Diet Coke and Coke Zero had sample means similar to the Coca-Cola Company's claimed caffeine levels. However, our sample Cherry Coke and Coke Classic displayed significantly lower caffeine levels than promised by the Coca-Cola Company.</p> <p><b>Conclusions/Discussion</b><br/>For Coke Zero, Diet Coke, and Caffeine-Free Coke, the company's claims were very similar to the means we obtained from the actual samples, suggesting that the named caffeine content is accurate for those Coca-Cola products. However, the data we obtained for Coke and Cherry Coke suggests that the caffeine content of at least some Coca-Cola products is not exactly what the company claims it to be. Coca-Cola making a cut in caffeine content like this would make sense, since a difference of just one milligram of caffeine per 12 ounces would save the company 14.6 million dollars over the course of a year.</p> |                                       |
| <b>Summary Statement</b><br>We tested Coca-Cola's claims for average caffeine content in five of its beverages using High Performance Liquid Chromatography.   |                                       |
| <b>Help Received</b><br>Dr. Malhotra provided us with the HPLC machine required for the project; Dr. Cauchon guided us through using the instrument for the first time and answered any questions we had about the experiment  |                                       |