



**CALIFORNIA SCIENCE & ENGINEERING FAIR
2019 PROJECT SUMMARY**

Name(s) Ingrid Feague	Project Number J0612
Project Title Taming Coulomb: How Solutes Affect the Reaction of Sodium Immersed in Water	
<p style="text-align: center;">Abstract</p> <p>Objectives I wanted to learn how the presence of various solutes (sugar, NaCl, KCl/NaCl mix) in an aqueous solution would affect the reaction of sodium submerged in the solution. My hypothesis was that all of the reactions will be slower than the control (pure water), with sugar solution slowest of all.</p> <p>Methods Sodium (0.05 oz samples); Water; Solutes: Salt (NaCl), Table Sugar, Lite Salt (KCl/NaCl mix); Video recorder Place a sodium sample in each of three fully saturated aqueous solutions of salt (NaCl), table sugar, and Lite Salt (KCl/NaCl mix), plus pure water as a control, measuring reaction duration and qualitative observations.</p> <p>Results Average reaction duration over three trials - Control (water): 10 sec + Coulomb explosion Sodium solution: 105 sec, NO explosion Sugar solution: 64 sec, NO explosion Lite Salt solution: 29 sec, NO explosion</p> <p>Conclusions The most interesting result was unexpected: sodium only exploded consistently in water. The presence of solutes inhibited the Coulomb Explosion. Sugar, salt, and Lite Salt solutions didn't explode, whereas the water exploded every time. The sugar caught lightly on fire, salt burned very little, and Lite Salt had an intense flame. My hypothesis was partly correct in that sodium reacted more slowly in aqueous solutions than pure water. But I expected sugar to be slowest, when in fact salt was slowest. I thought the ionic solutions (salt and Lite Salt) would behave similarly because the Lite Salt is half salt, half KCl, so they are very similar substances. But the results were very different in both time and quality. Nuclear plants sometimes use liquid sodium for cooling. If a tsunami hits a plant (like in Fukushima, Japan), it could be very useful to know that sodium won't explode in saltwater.</p>	
Summary Statement I tested the effect of the presence of solutes on the reaction of sodium when submerged in various aqueous solutions vs. pure water and found that solutes slowed the reaction and consistently inhibited Coulomb explosion of the sodium.	
Help Received My father was my assistant throughout my project. He videoed my tests, helped me write and helped me prepare for judge's interviews. My science teacher helped me understand my experiment fully and answered all of my curious questions. My mother's cousin (a chemist) gave me ideas for follow-up	