



**CALIFORNIA STATE SCIENCE FAIR
2007 PROJECT SUMMARY**

Name(s) Drew A. Vecchio	Project Number J1230
Project Title Suppressing Metal Alloy Melting Temperatures: Does Size Matter?	
Abstract Objectives/Goals The first goal of the experiment is to find the lowest melting temperature of a eutectic Pb-Sn alloy. By adding a small amount of a third element to the Pb-Sn eutectic melt, the experimenter could achieve the second goal to determine which addition suppressed the Pb-Sn eutectic temperature. Comparison of the atomic size ratios between these third element additions with Pb and Sn allowed their affect on the melting temperatures to be determined. Methods/Materials Materials used are: lead, tin, indium, silver, antimony, gallium, a hotplate, thermocouple, temperature measurement display, crucibles, a scale, and insulation. All elements are weighed, the required ratios placed in a crucible and melted on the hot plate. The temperature of the melt was measured as it cooled. Results The eutectic composition was determined to be ~62wt%Sn ~38wt%Pb, and the eutectic temperature found to be 183°C. The eutectic alloy with indium added froze at 179° for 1wt% and 173°C for 5wt% alloy additions, with silver added it froze at 179°C for both addition amounts, with antimony added it froze at 184° for 1wt% and 187°C for 5wt% additions, with gallium added it froze at 174° for 1wt% and 163°C for 5wt% additions. Conclusions/Discussion The addition of gallium decreased the eutectic temperature from 183°C to 163°C, the greatest decrease among the alloy additions investigated. The elements whose atomic size is similar to lead and tin (silver, antimony) had very little affect of suppressing the eutectic melting temperature. Elements whose atomic size differed significantly from Pb-Sn had the greatest effect (indium, gallium).	
Summary Statement It was possible to determine the eutectic Pb-Sn composition and temperature using the cooling curves of the Pb-Sn melts.	
Help Received Father provided materials and supervision. Brothers and other family members gave small contributions.	