CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

Name(s)
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Project Number
S0527

Project Title
Molecular Mass of a Volatile Liquid Derived through Increasing Temperature

Abstract

Objectives/Goals
Volatile liquids vaporize at low temperatures. It has been proven that by increasing temperature, the kinetic energy of the molecules increases, and likewise, the number of molecules changing from a latent liquid state into a gas state also increases.

Methods/Materials
In order to test the hypothesis that increased temperature will result in a more accurate calculation of molecular mass, acetone was allowed to vaporize at a specified temperature and condense. The resulting liquid was massed and the figure, in terms of m, placed in the formula M=mRT/PV. Four different temperatures ranges were tested. The volume of the test tube, the pressure of the atmosphere, and the R constant were also determined. By solving the formula, the M variable (molecular mass) was determined and compared with the known molecular mass of acetone (58.09g).

Results
The molecular mass decreased as the temperatures increased, deviating from 164g and lowering to an accurate 61.5g. Lines of best fit shows strong correlations (above -0.96) between temperature and several variables.

Conclusions/Discussion
Explanation is due to the nature of acetone molecules; they remain bonded together at low temperatures. A decreased number of molecules results in decreased pressure and subsquently, a minute amount of excess vapor being eliminated. This causes a large quantity of condensed vapor to be massed and a higher, inaccurate molecular mass results. By increasing temperatures, the exact opposite occurs. The molecules become more excited, the pressure increases and all excess vapor is expelled. Less liquid is massed and therefore, the molecular mass is much more accurate.

Summary Statement
Showing the relationship between increasing temperatures and the behavior of vaporized gases at the established temperature.

Help Received
Used laboratory equipment at Southwest High School under the supervision of Mr. V. Bowen.