CALIFORNIA STATE SCIENCE FAIR
2002 PROJECT SUMMARY

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Project Number
22167

Project Title
Fast Gas

Abstract

Objectives/Goals
The purpose of our experiment was to see how temperature affected gas diffusion. We looked at ht different temperatures affected the diffusion of chemicals. We also wanted to know how the temperature would affect the distance the molecules traveled.

Methods/Materials
To start the experiment, we obtained two chemicals; an acid, concentrated hydrochloric acid (HCl), and a base, concentrated ammonium (NH(4)). We placed several drops of the chemicals each on to a differenx Q-tip. Then we inserted the two Q-tips in opposite ends of a 100cm piece of glass tubing simultaneously. We closed the ends using rubber stoppers. We placed the tube carefully into a water bath and started the stopwatch. For the several trials, the water was set at different temperatures. The three temperatures we used were 30ºC, 25ºC, and 20ºC. When the gas molecules from the two chemicals collided with eact other in the tube, they reacted and form a white ring, which was NH(4)Cl, or ammonium chloride. We stopped the stopwatch and recorded the time when a complete white ring had formed on the inside.

Results
The results were as our research had suggested. At the lower temperature, it took a while for the white ring to show up. At the higher temperature, the white ring appeared much faster. The white ring appeared on the hydrochloric acid side of the tube, it wasn#t in the middle. At the higher temperature, the ring was farther from the end of the HCl Q-tip than where it was at the lower temperature.

Conclusions/Discussion
At the higher temperature, the white ring formed more quickly because the gas expanded with the heatx The heat increased the gas molecules# average kinetic energy and they traveled faster down the tube. At the lower temperature, the white ring took more time to appear. The molecules didn#t expand as muchx and had less average kinetic energy. That is why it took them a longer time to travel down the tube. The NH(4)Cl appeared on the HCl side for a reason. An HCl molecule has more molar mass than NH(4). Thex NH(4) molecules were lighter, thus enabling them to travel faster down the tube. When the two gasesx met, their reaction appeared on the HCl side of the tube. The ring appeared at different spots on the tube because the heat affected the two chemicals differently so they didn't always meet in the same spot.

Summary Statement
How temperature affects gas diffusion

Help Received
Chemistry teacher helped us with idea and let us borrow lab supplies; Galileo Academy lent us the glass tube