CHEMISTRY 101L DATA SUMMARY

EXPT. 5

Gas Forming Reactions and Rockets

Your name:	Joe Puccio	Lab Section	425
Your partner's name	Jake Evans	Date	8/20/15

Results

Table 1. Experimental Results from various H_2:O_2 ratios and collection orders (H_2 or O_2).

Trial Number	Gas Collected First	Ratio H_2:O_2	Distance Rocket Traveled
Trial 1	H_2	1:1	0 feet
Trial 2	O_2	1:1	7 feet
Trial 3	O_2	2:1	12 feet
Trial 4	H_2	2:1	0 feet

During Trial 1, there was unfortunately a lot of air (atmospheric gas) added during the experiment which very likely reduced the effectiveness of the rocket because the majority of atmospheric gas is Nitrogen, an inert gas. The rocket did not launch at all, but there was some noise when launching (a small popping sound). There were no noticeable smells from the combustion.

During Trial 2, a small amount of little air (atmospheric gas) was added during the collection process. The smell after ignition was very noticeable, though. It smelled like fireworks. The rocket launched 7 feet, significantly more than the previous trial.

During Trial 3, a very small amount of air was added during the collection process. The smell after ignition was not noticeable. The rocket launched 12 feet. This was significantly better than the previous trial.

During Trial 4, very little air was added during the collection process. The smell was noticeable this time however the rocket did not launch at all (0 feet).

Our trials suggest that adding the O_2 gas first was essential for the reaction to take place, as we can see that both times that the H_2 gas was collected first, our rocket traveled no distance. Moreover, our trials suggest that the ideal ratio of H_2 to O_2 is 2:1, respectively. Our trials reveal this as it was this 2:1 ratio that had the best distance traveled, which was 71% better than our second best trial which had a 1:1 ratio. It was unexpected that two of the trials, both of which we started by collecting H_2 first, resulted in a 0 distance traveled by the rocket. Our results were surely complicated by variable amounts of air being added in each trial. As we got better at the process, the amount of air added decreased, which means that our results could be skewed positively towards our latter results.

Table 2. [TA instructed us not to create]

Discussion

Our Zinc HCl reaction which we used to generate our H_2 gas can be represented by the following balanced equation:

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

And the combustion of our H_2 and O_2 fuel can be represented by the following balanced equation:

$$2H_2 + O_2 \rightarrow H_2O$$

Based on our observations, the reaction of hydrogen and oxygen to generate water is an exothermic reaction, because this reaction releases energy into the environment. We can see this is the case as the rockets in our trials were propelled (caused into motion) by the released energy of this reaction. By conservation of energy, this propulsion would not be possible if the reaction did not release energy into the environment.

Based on the balanced equations, we can conclude that the ideal ratio of hydrogen gas to oxygen gas is 2:1, as in order to exhaust all of the fuel in the tube, there must be 2 hydrogen gas molecules for every oxygen gas molecule. It appears as though oxygen should be added first as these trials yielded the best results in our experiment. Impurities could come into play as our apparatus for harnessing one of the gasses could have been more effective in delivering its gas (this could have to do with the relative densities of the produced gasses, as well.

Our data supports the theoretical hypothesis that the ideal ratio of hydrogen gas to oxygen gas is 2:1, as well as the supposition that oxygen should be added first (perhaps to achieve better mixing because the oxygen gas is denser than the hydrogen so by adding it first.

Possible sources of error are that we inadvertently added a variable amount of air to our rockets, and these trials that we added more air are more likely to be less effective than those where we added less air. This is very likely the largest source of error in our experiment.