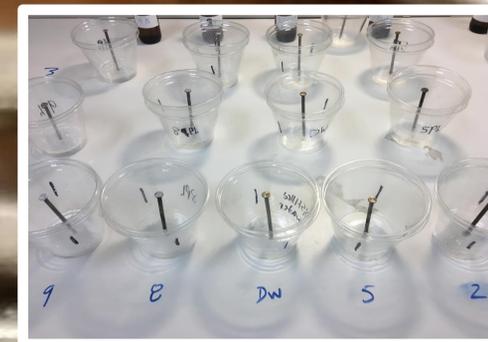


# pH and Nails

By Chowan Middle School Students



## Introduction/Rational

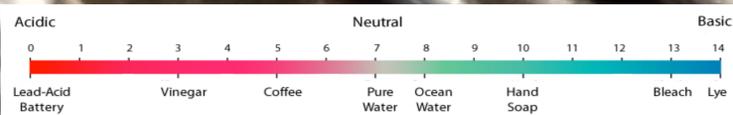
Savanna and Samantha dive deep to answer your biggest question: Do nails rust faster with different pH levels? We had inspiration from home builders, and our concern for future/old buildings. But why do we do this? To make sure your nails do not rust. Nails are what holds a lot of buildings, furniture, decks, and more together. Another reason for doing this project is to help acknowledge the problem of acid rain. In recent years it's gotten worse in some parts of the country, and your nails might end up like ours.

## Research Problem

Our question is simple: Would different pH levels make nails rust faster or slower?

## Hypothesis

We think that the nails will rust faster with lower pH than higher pH and the more neutral pH will stop the nails from rusting.



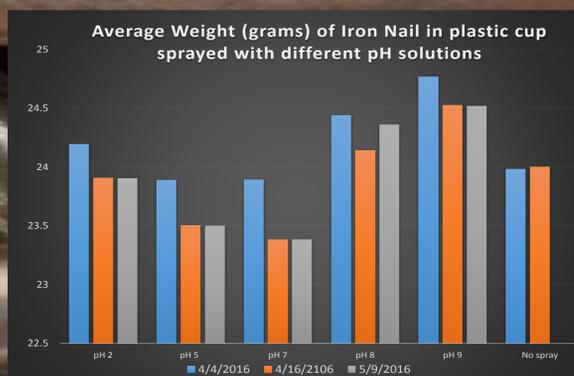
## Materials and Methods

- iron nails
- clear plastic cups
- spray bottles
- vinegar
- baking soda
- distilled water
- protective goggles and gloves
- analytical balance



We mixed up solutions with distilled water and either baking soda to make the basic pH or vinegar to make the acid pH. We weighed the nails and cups before we started spraying. We sprayed the nails once each from the left, right, front, back, and top – repeated the spraying of the nails every Monday, Wednesday and Thursday. Then we found out that weighing the nails could be useless because of the residue of the baking soda.

## Results



The nails sprayed with lower pH solutions lost a small amount of weight and rusted a lot. The nails sprayed with higher pH solutions mostly had increases in their weight but that may be because the baking soda was left as a residue on the plastic cup from the spray. No rust on these nails.

Average Weight (grams) of Iron Nail in plastic cup sprayed with different pH solutions

	pH 2	pH 5	pH 7	pH 8	pH 9	No spray	Observations
4/4/2016	24.193	23.888	23.8903	24.4403	24.7656	23.981	Control had some rust -more that distilled water(pH-7), all the base pH nails have no rust but spray has created a residue on the cup and nail. Acid sprayed nails very rusty.
4/16/2106	23.907	23.503	23.384	24.141	24.5236	24.001	
5/9/2016	23.904	23.5	23.382	24.3597	24.5197		No spray from last sample due to Spring Break

## Discussion of Results

The nails and cup with residue from the dried baking soda (base) weighed more which caused unexpected problems in how we could measure change in the nail as they rusted. With all the nail weight in the same category being off, we think we should have found a better way to spray each nail, and get a better spray bottle for more accurate and even measurements. The spray bottle also could have changed the pH of the solutions over time and made it a different pH.

## Conclusion

Our hypothesis was partly incorrect we were right about the lower pH having more effects with rusting, but we were wrong with the more neutral the pH making the nails rust less. We found out that higher pH makes nails rust less.

## References

- <https://www.wonderopolis.org/wonder/why-do-some-things-rust>
- <http://scienceline.ucsb.edu/getkey.php?key=552>

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