

## 1. Abstract : Physic + Chemistry

The experiment is about launching the rocket by the using process of chemical reaction. It is recommended to determine the proper amount of chemical used. Some of the materials including a plastic bottle, vinegar, and baking soda.

## 2. Introduction : Overview

In this project, the rocket was launched by acid and base. The reaction between base( $\text{NaHCO}_3$  or baking soda) and acid( $\text{CH}_3\text{COOH}$  or vinegar) creates gas ( $\text{CO}_2$ (Carbon-Dioxide)). This gas is what creates the pressure inside the bottle, which will allows the cork to pop out and the bottle(rocket) to fly. In addition, the goal of the experiment is to make the rocket hit the target. This requires a proper amount of both substances that will be fully used up in order to create the perfect amount of pressure that will available the rocket to hit the target.

3. Objectives : The purpose of this project is to determine the exact ratio of baking soda and vinegar in order to launch the rocket and hit the target.

## 4. Materials and Methods

Materials :

- 1L Plastic Bottle
- Tape
- Baking Soda
- Vinegar
- Painting Spray
- Pipe
- Flute board
- Rubber cork

Methods:

Before beginning the project, make sure to prepare the materials for making rocket. Using a paper to sketch the wings and place it onto the flute board. Carefully, cut the wings out. Then, stick the wings to the water bottle equally onto the bottle. By placing it unequally can cause to the failure in launching the rocket. Next, cut a half circle on a cardstock and roll it to create a cone-like tip of the rocket. Stick it to the bottom of the bottle. The last step of making the rocket is to decorate it.

Next, in order to launch the rocket to hit the target, the launcher is required. Without it, the rocket will not be able to fly in the preferred direction and will not be able to hit the target.

For the launching process, first, prepare the baking soda, vinegar, and measuring equipments. Measure the preferred amount of baking soda and vinegar then record the date. It is recommended to record the data in order to know how much more or less the chemical should be used to hit the goal. Next, fill the bottle with the measured vinegar. Put the baking

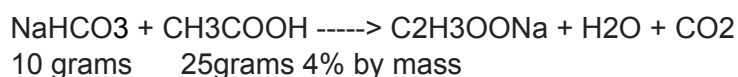
soda flatly onto the tissue, roll it, and tape the top and end part. This will help slowing down the chemical reaction process. Place the rolled tissue into the bottle. Immediately, put on the rubber cork then flip the rocket over and place onto the launcher.

## 5. Results and data tables

Chemical equation: $\text{NaHCO}_3 + \text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COONa} + \text{CO}_2 + \text{H}_2\text{O}$												
Trail#	Vinegar			Baking soda			Gas			Angle	Distance	Hit the target
	Volume (ml)	Mw	mol	Mass(g)	Mw	mol	mol	Mw	g			
1	250	84	0.12	25	60	0.4	0.12	44	5.28	40	12m	NO
2	350	84	0.17	35	60	0.58	0.17	44	7.48	40	13m	NO
3	400	84	0.20	40	60	0.67	0.20	44	8.8	40	0m	NO
4	350	84	0.17	33	60	0.55	0.17	44	7.48	40	10m	NO
5	300	84	0.14	28	60	0.47	0.14	44	6.16	40	15m	NO
6	200	84	0.01	18	60	0.3	0.01	44	0.44	40	11m	NO

## 6. Discussion : Calculation + Suggestion

Calculation :



10grams of  $\text{NaHCO}_3$  x 1 mol of  $\text{NaHCO}_3$  / 84 grams of  $\text{NaHCO}_3$  = 0.12 mol of  $\text{NaHCO}_3$   
 0.12 mol of  $\text{NaHCO}_3$  x 1 mol of  $\text{CO}_2$  / 1 mol of  $\text{NaHCO}_3$  = 0.12 mol of  $\text{CO}_2$   
 0.12 mol of  $\text{CO}_2$  x 22.4 liters of  $\text{CO}_2$  / 1 mol of  $\text{CO}_2$  = 2.69 liters of  $\text{CO}_2$

25 gram of  $\text{CH}_3\text{COOH}$  x 1 mol of  $\text{CH}_3\text{COOH}$  / 60 grams of  $\text{CH}_3\text{COOH}$  = 0.04 mol of  $\text{CH}_3\text{COOH}$   
 0.04 mol of  $\text{CH}_3\text{COOH}$  x 1 mol of  $\text{CO}_2$  / 1 mol of  $\text{CH}_3\text{COOH}$  = 0.04 mol of  $\text{CO}_2$   
 0.04 mol of  $\text{CO}_2$  x 22.4 liters of  $\text{CO}_2$  / 1 mol of  $\text{CO}_2$  = 0.90 liters of  $\text{CO}_2$   
 $\text{CH}_3\text{COOH}$  is the limiting agent.

## 7. Conclusion

In conclusion, the rocket can be launched and hit the target by using the simplest ratio of the base and acid. The pressure in the rocket makes the rubber pops out and the gas inside determine the amount of pressure which will result in the distance of rocket launched. In

addition, there are also some other external factors, for example, the wings of the rocket, the wind direction, etc.

## 8. References