Airbag challenge (At home investigation)

Image from: https://www.carmagazine.co.uk/car-news/tech/airbag-technology/

Honda Car Company is looking for new ways to create air bags that are safer. You are asked to help the Company to test a new way of inflating a bag with a gas. During your design phase, you must decide how to generate enough gas to fill a small plastic bag using baking soda ($NaHCO_3$) and 5 % (0.81 M) vinegar (CH3COOH). After completing your investigation you need to write a report about how you completed your experimentation and give a recommendation to the Company about ways to make airbags safer.

To help you with your task I had collected data from three different trials using the given materials. I used cabbage juice to monitor what is going on during the reaction. Please look at the images and write what do you notice is happening in each trial? What do you see that made you say that?

Your answer:

Bag #1(Trail 1) Bag #2(Trail 2) Bag #3(Trail3)

To understand what is happening during deployment of airbags during car crash watch the following videos:

Takata Recall: https://safeYouTube.net/w/EkOC

How do airbags work? https://safeYouTube.net/w/olOC

Suggested equipment to be used at home for the investigation:

Measuring cup, small food balance, tea spoon, table spoon, small plastic reusable bag, and thermometer.

1 teaspoon = 4.2 g

1 tablespoon = 15 g

Day 1:

1. Before starting the investigation, please use a few minutes to brainstorm all of the things that you will have to think about to inflate the bag with the maximum firmness using the household materials.
2. What do you think is the most important to try to figure out first? Why is it important?
3. What other factors you may need to consider to design your experiment? Why are they important?
4. What safety should be considered when designing the airbag?
   Glasses would make the experiment a lot safer! Start with a lower amount of proportions and build up from there. Be aware of pets in the house!
5. What do you plan to try to inflate the bag to its firmness? Write your experimental procedure in detail giving the quantities and how you will be placing it in the bag. Show any calculations that may support your thinking for choosing the specific quantities.

Day 2:

At the end of your experimentation. Please write your answers to these questions.

1. What was successful in your experimental design? What did you learn about inflating the bag?
2. What obstacles did you encounter? What did you learn about what doesn't work?
3. Now that you had finished the challenge and made the bag with the best firmness, what did you determine was important to consider to inflate the bag? Why was it important?
4. Now that you completed the challenge, make recommendations about the best and safest way to make the airbags.
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Acknowledgment: The idea for the airbag challenge came from a workshop on Laying the Foundations in Chemistry