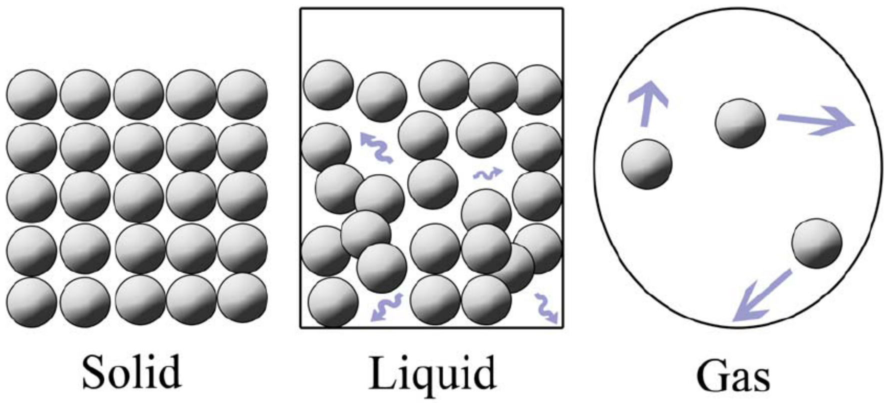
MENTOS AND DIET COKE ACTIVITY
(Source: Eichler et al., 2007, JChemEd)

General Background:
The three primary states of matter are solids, liquids, and gases.



Solids. The molecules in a solid are vibrating, but they held very tightly together and are kept in fixed positions. They are very difficult to compress and are unable to flow. Thus, they have a constant shape and volume. When a solid is heated, the molecules move faster, and they are able to break away from the rigid solid structure.

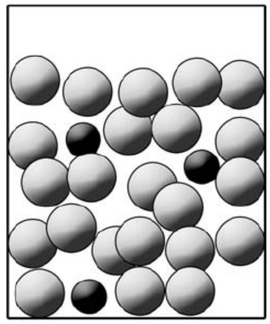
Some solids can be dissolved into some liquids. Whether or not a solid is soluble in the liquid depends on the properties of the substances, the temperature, and the solution concentration. When a solid is completely dissolved in a liquid, the solution will become transparent.

Liquids. The molecules in a liquid are still fairly close together, but they are able to move freely . The volume of a liquid is constant, but its shape changes to fit the container.

Gases. The molecules in a gas are very far apart and move at very high speeds. Gases fill the volume and shape of the container in which they are placed.

Gases can also be dissolved into a liquid. When a gas is completely dissolved in a liquid, you won't be able to see bubbles. (Observe the soda bottle before you open it.) To dissolve a gas in a liquid, just bubble the gas through the liquid. The gas molecules will be "caught" by the liquid molecules!

More gas can be dissolved in a liquid under high pressures and low temperatures. This is why a soda can is kept pressurized and cold. If left open and warm, the dissolved carbon dioxide gas will leave, and the soda becomes "flat."



Liquid with dissolved gas

How are bubbles formed in a reaction?

1. **A physical reaction.** Dissolved gas simply separates from the solution as bubbles. You can observe this type of reaction by shaking a soda can and then opening it.

2. **Chemical reaction.** The chemicals combine to form a gas.
You can observe this reaction by placing an antacid into orange juice. When the antacid neutralizes the acidic orange juice, carbon dioxide gas is formed.

Procedural Advice:

1. In order to save on materials, you will test your hypothesis by doing a series of experiments where you use 1 mentos and place it in a 16-20 oz. bottle of the specified beverage.

2. You will be given a measuring stick to determine how vigorous each "reaction" is.

3. Each group should do 2 trials (for each experiment) in order to provide some assurance that the experiments are repeatable.

4. Be sure to document all experimental parameters and results in your lab notebook.

5. The data from all the groups in your lab section will be compiled in order to help determine the precision of the experimental procedures. You should then calculate the standard deviation for each experiment:

Standard Deviation (SD) = $\sqrt{[(1/n)(\text{sum } (x_i - x_{avg})^2)]}$

n = number of data points
x_i = individual data points
x_{avg} = mean of data points = sum x_i / n

The standard deviation should be reported to the same number of decimal places (not significant digits) as the average value. Thus, if you calculate the SD to be 0.0026 and your average value is 2.225, you should report this data as 2.225 +/- 0.003.

Data Analysis and Conclusions:

1. Which experiments confirmed your hypothesis? Which disproved your hypothesis? Be sure to explain why each experiment confirmed/disproved your hypothesis.

2. Based on your standard deviations, are you confident that all of your experimental results are trustworthy?

3. Based on the analysis of your results, would you modify your hypothesis? How?

Mentos Lab
Post-lab reflection

Answer the following questions by circling the number that corresponds to your feeling/opinion (1=strongly disagree, 2=disagree, 3=not sure, 4=agree, 5=strongly agree):

1. The process used for this lab was very different from labs you have done in previous science courses (courses here at Oxford or elsewhere).

1 2 3 4 5

2. The process used for this lab was about the same as labs you have done in previous science courses (course here at Oxford or elsewhere).

1 2 3 4 5

3. The way this lab was structured allowed you to be involved in the process of creating a hypothesis.

1 2 3 4 5

4. The way this lab was structured allowed you to be involved in the process of designing the actual experiments that were done in the lab.

1 2 3 4 5

5. You were interested to see whether the hypothesis was confirmed or disproved by the collected data.

1 2 3 4 5

6. Overall, you found this lab to be a positive learning experience.

1 2 3 4 5

7. This lab has increased your interest in science.

1 2 3 4 5

8. This lab has increased your confidence in the ability to do scientific work.

1 2 3 4 5

9. This lab has increased your understanding about the "process" scientists use.

1 2 3 4 5

<u>Written Reflection</u>:

Please write a paragraph or two that describes your feelings towards this lab experience. What aspects of it did you like? Dislike? If this lab was different from your previous lab experiences, explain how.