

POP GOES THE POPCORN

PROBLEM PRESENTATION / EXPLORATION

- A. How many of you have plans to take chemistry? How many of you have ever "used" chemistry? Does anyone "use" chemistry every day? Well, guess what? You each use chemistry every single day of your lives! If you have ever used a household cleaner, or cooked your favorite food, or **eaten your favorite food**, then you have used chemistry. Food is made of carbohydrates, fats, proteins, and other organic material, which are all studied in a branch of chemistry that we call organic chemistry.
- B. Popcorn, for example, is made up of protein and fat, which you need in your diet. Have you ever thought about what happens when you pop popcorn? How do those small kernels become fluffy and soft? Have you ever noticed that almost always all of the kernels do not pop? Have you ever wondered why?
- C. The CHALLENGE in this experiment will be to determine if all popcorn pops the same way.
- D. The materials needed for this experiment are 125 mL of popcorn, a cookie sheet, an oven, and a popcorn popper, or large pot. (If a microwave oven is more accessible, this might serve as a good alternative -- Use the loose microwave popcorn that comes in a bottle if you will be using a microwave oven.)
- E. This activity can be completed as a homework assignment or students may be divided into five equal groups for work in the lab.
- F. "Measure out 50 mL of popcorn kernels and count them. Count a second group of kernels equal in number to the first. Preheat the oven to 200°F (93°C). Spread group #2 of the kernels onto the cookie sheet and place them in the oven for 90 minutes. Next, pop the group #1 kernels. Do not use any oil. After popping, count the number of unpopped kernels and record. Then choose ten of the popped kernels and measure the length of each in mm, recording all measurements. Add the 10 measurements and divide by 10 in order to obtain an average. Record the average. After 90 minutes, remove group #2 from the oven and allow to cool. Then pop in exactly the same way as group #1. Again, count the number of unpopped kernels and record. Measure ten of the popped kernels in mm and record each measurement. Again, add the 10 measurements and divide by 10 in order to obtain an average. Record the results. Eat one kernel from each group and compare. Is there any difference in taste?"

# of Unpopped Kernels	
Group #1	Group #2

Kernel #	Group #1 Length (mm)	Group #2 Length (mm)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

CLASS RESPONSE / CONCEPT INVENTION

- A. Have each group report their results to the class. Record on the chalkboard or on an overhead transparency. If students worked individually at home, allow each student to report his or her results. What happened? Why was there a difference between the two batches of popcorn? HINT: What was the only variable that you altered in your experiment? (Students should realize at this point that the kernel contains moisture, and that the moisture is what makes the corn pop. If the moisture is heated very quickly, it vaporizes into steam and expands rapidly, causing the kernel to explode.) If the kernels are heated slowly, some of the moisture escapes and then when heated rapidly not enough water will be left to explode and make all of the kernels pop.
- B. Determine the % of water in popcorn.
1. Do all kernels of popcorn have the same amount of water in them? The easiest way is to pop them one at a time and find out.
 2. Have each group in the class pop two individual kernels in the following manner.
 3. Weigh each kernel before it has popped and record its mass.
 4. Place a single kernel in a 500 mL Erlenmeyer flask with a cork loosely in the mouth. Attach a clamp to the flask and to a ring stand.
 5. In your hand hold a Bunsen burner and aim it at the flask. Move the flame over the bottom of the flask evenly. Soon the kernel will pop into a flower of popcorn.
 6. Immediately upon popping remove the clamp from the ring stand and agitate the flask so that the flower of popcorn will not stick to the bottom of the flask.
 7. Remove the flower of popcorn and weigh it. Make sure that it has cooled to room temperature before weighing.
 8. Note what is deposited on the inside of the flask [Water]
- C. Fill in the information in the following table

Kernel #	1	2	3	4	5	6	7	8	9	10
Mass Before										
Mass After										
Diff in Mass										
% Mass Lost										

What is the average % mass lost (H_2O lost) of these ten kernels?

CONCEPT EXTENSION

- A. What would happen if stale popcorn were allowed to soak in water overnight? Design your own experiment to see what might happen.
- B. What do you think is the difference between microwave popcorn and regular popcorn? Can you use regular popcorn in a microwave oven? Can you use microwave popcorn in oil and a regular corn popper? What do you think the percentage of water in popcorn has to do with these questions. [Microwave popcorn has a larger % of water than regular popcorn.]