Forensic Science:

How much water is in popcorn?

Purpose: To determine the percentage (by mass) of water in dry popcorn kernels from name brand and generic sources.

Background: Popcorn kernels contain a certain amount of water. When the kernel is heated, the water inside becomes superheated (i.e., it remains in the liquid phase rather than vaporizing because it does not have enough room to expand). This superheated water enters the endosperm of the kernel under high pressure, causing the outer covering of kernel to rupture. This sudden drop in pressure allows the water molecules to expand and turn to vapor. The rapid expansion of the water (and endosperm) causes the kernel to pop.

General Procedure: You will be provided with a 500-mL Erlenmeyer flask fixed with a one-hole rubber stopper to pop the popcorn inside. You should use between 1 and 25 kernels of dry popcorn for each trial. **Add enough oil to completely cover the bottom of the flask before popping the kernels.** Heat the oil slowly over the hotplate and then remove the flask from the heat as soon as popping in completed. In the end, you will need to determine the percentage (by mass) of water in dry popcorn kernels from both the name brand and the generic sources. Compare and contrast the percent water and the percent popped versus unpopped for each type of kernel. Keep in mind that good scientists always use multiple pieces of data before reporting data, and they are careful to use appropriate significant figures. **It is the responsibility of your group to determine the exact procedure that will be used. This includes the specific measurements that will be made and when they will be made.**

Safety and Waste: There is very little, if any, toxicity of popcorn kernels and vegetable oil; however, eating of the popcorn is absolutely forbidden because it was prepared in a laboratory setting. There are no guarantees that contamination did not occur. The waste in this lab is non-hazardous so it can be disposed of in the trashcans in the lab. Be sure to use the three-prong clamp to handle the Erlenmeyer flask during heating. Also, do not set the hot flask directly down on any surface until it has cooled.

Materials:

Any glassware contained in your locker

500-mL Erlenmeyer flasks

1-hole rubber stoppers

Hot plates

Electronic balances

Name brand, generic, and old popcorn kernels

Vegetable oil

(It is up to the instructor's discretion to provide other materials)

Prelab: (Do this individually and compile procedures in lab as a group for section 3 in your notebook.)

1. Write a step-by-step procedure for determining the percentage of water in dry popcorn kernels. Focus on the measurements that will need to be made (the data to be collected) and on the calculations that will need to be made to determine the final percentage.

Lab Report: (Due at the beginning of the next lab period.)

1. *Data and Results Table (sect. 6)* – Include a data table that includes all of the measurements made for each of the trials in your experiment. Be sure to record measurements with the appropriate level of precision. Include the results from each trial with the appropriate number of significant figures. Include your qualitative observations from the experiment also.

2. *Sample Calculations (sect. 6)* – Include one complete sample calculation showing how the data were used to find the percentage of water in one trial.

3. *Experimental Questions* – Thoughtfully answer the question below. Use complete sentences.

1. What can you conclude from your experimental results? Use these results in your answer.

2. Comment on the accuracy and the precision of your results.

3. What systematic errors can you identify in this experiment? How might you modify the experiment to eliminate or minimize these errors?

4. If popcorn kernels are pierced with a pin before heating, the kernels do not pop. Explain.

5. Some consumers suggest storing popcorn in a sealed container in the freezer. Why do you think that this would increase the storage time of popcorn?