Chemistry
Lab Makeup

Name _____
Date_____Block___

Read the introduction to this lab to understand the background. Then, using the theoretical data provided, answer the questions.

How Much 'Pop' is in Popcorn?

Introduction

Corn is a common food, native to the Americas, which appears in many forms: corn on the cob, corn off the cob, creamed corn, and popcorn. Field corn, which is also fed to livestock, is hung on our doors at Halloween. Each variety of corn contains different amounts of water, sugars, and starches. Popping popcorn involves heating the corn until the pressure inside the kernel is great enough to cause it to burst, turning the kernel inside out and releasing the trapped moisture.

Purpose

To determine the percent water in popcorn, to use the ideal gas law to determine the pressure inside the kernel when it pops, and to solve gas law problems.

Safety

- Wear protective goggles/keep hair tied back throughout the laboratory activity.
- Heat the flask evenly to prevent spattering the oil.
- Heat with care. Oil is flammable.
- **DO NOT EAT THE POPCORN!!!**

Procedure

1. Record the mass of a weighing cup.
2. Add 16 kernels of un-popped popcorn and reweigh. Record the mass.

3. Calculate the mass of the un-popped popcorn kernels. Record the mass.

4. Using the water displacement method, find the volume of the 16 un-popped kernels. Use a 10-mL graduated cylinder. Dry the kernels after determining their volume. Record.

5. Add two medicine droppers (not drops) of cooking oil and the 16 un-popped kernels to an empty, dry 125-mL Erlenmeyer flask.

6. Determine the mass of the flask, oil, and un-popped popcorn. **Note: the un-popped kernels contain water!*

7. Assemble a ring stand with ring, placing a wire gauze on top of the ring.

8. Using a utility clamp, fasten the flask to the stand so it sits on the wire gauze. Cover the flask with a piece of wire gauze (small).

9. Light the burner and carefully move it back and forth (slowly/low heat) until the popcorn just begins to pop. Remove the heat when most of the kernels have popped. **Do not burn the popcorn**. *Note: the popped kernels DO NOT contain water!*

10. Let the flask cool, then remove and determine the mass of the flask and popped popcorn.

DATA COLLECTED	CALCULATIONS TO BE DONE
Mass of weighing cup (g) **1.81 g** Mass of corn + weighing cup (g) **4.24 g** Volume of water (mL) **3.9 mL** Volume of water and corn (mL) **5.7 mL**	Mass of un-popped kernels (g) Volume of un-popped popcorn kernels (mL) Volume of un-popped popcorn kernels (L)
Mass of flask, oil, and un-popped popcorn (g) **69.70 g** *Remember, un-popped kernels contain water!*	Mass of water lost (g) Moles of water lost (g → moles)
Mass of flask, oil, and popped popcorn (g) **69.29 g** *Remember, popped kernels DO NOT contain water!*	***Follow "Help with Your Calculations" for the next items…*** ***Percent of water in kernels ****Pressure of steam inside kernel at time of pop

Help with Your Calculations **Please show work on separate piece of paper.**

***Percent of water in "popcorn" = [Mass of water lost / Mass of 16 kernels] x 100 = %**
**** To estimate the pressure of the water vapor at the time of "pop," use **PV = nRT** Here are some hints regarding this calculation: Step 1. Rearrange the equation to solve for **P**. Step 2. Use the "moles of water lost" from the data table. Step 3. R = **0.0821** L·atm/(mol·K) Step 4. Assume that the popcorn pops at the boiling point of the cooking oil (225 °C) and convert this temperature to Kelvins. Step 5. The volume of the gas is equal to the volume of the un-popped kernels (use Liters)

Follow Up

1. What was the percent water in your popcorn?

2. Name one way in which popcorn, corn on the cob, and field corn are different (*Google search*).

3. What is the pressure of the water (as a gas) inside the popcorn just as it pops?

4. What was the atmospheric pressure in the laboratory during this activity?
   The teacher will write this on the board. **770.4 mm Hg when the experiment was performed.**

5. Compare the pressure required to "pop" corn (Question 3) with atmospheric pressure (Question 4).

6. What assumptions have you made that might cause errors in your calculation of pressure?