LAB 21, HEAT OF VAPORIZATION

Name _____ Period_____

Part I: The heat of vaporization is the amount of heat required to vaporize one gram of a liquid substance at its normal boiling point without any change in its temperature. In this experiment the heat of vaporizaztion of water will be determined by using the method of mixtures. A known mass of steam at a measured temperature will be passed into a known mass of cold water at a measured temperature. The number of calories that the steam yields as it condenses can be calculated from the rise in temperature of the water.
Two things happen when the steam loses heat: (1) the steam condenses; (2) the hot water formed from the condensed steam (the condensate) heats up the cold water in the calorimeter.

PROCEDURE with GOGS ON!

1. **Clamp** a 150mL flask to the ring stand over a wire screen on the ring. This will be the steam boiler. Fill it **HALF FULL** of water. We shall use a rubber tube to conduct the invisible vapor (live steam) into a styrofoam calorimeter.
1. Mass the empty cup calorimeter and record it in the data table below.
2. Fill it **HALF FULL** full of tap water and determine the combined mass of the cup and water. Record it.
3. With a thermometer, stir the water, measure and record its temperature.
4. Light the burner and heat the the water to boiling. **GOGS ON!**
5. When steam is roaring out of the rubber tube, place the tube into the water holding it at the bottom of the cup.
6. Stir continuously with the thermometer until the temperature rises to about 35 ^{o}C. Then remove the tube from the calorimeter and **record the highest temperature reached**.
7. Remove the burner.
8. Mass the cup with the water plus the steam condensate therein and record it.
9. The temperature of the steam is the same as that of the boiling water in the flask, 100^{o}C.

Data Table

Mass Empty Cup g	Mass Cup + water g	Initial temp water in cup oC	Final temp of water in cup ^{o}C	Mass Cup +water+steam condensate g	Temp of Steam Condenstate ^{o}C
.	.	.	.	.	100^{o}C

CALCULATIONS:

1. Calculate the mass of the water in the cup and record it in the Calculations Table below.

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2. Calculate the temperature change, **Δt**, of the water in the cup and record it in the Calculations Table below.

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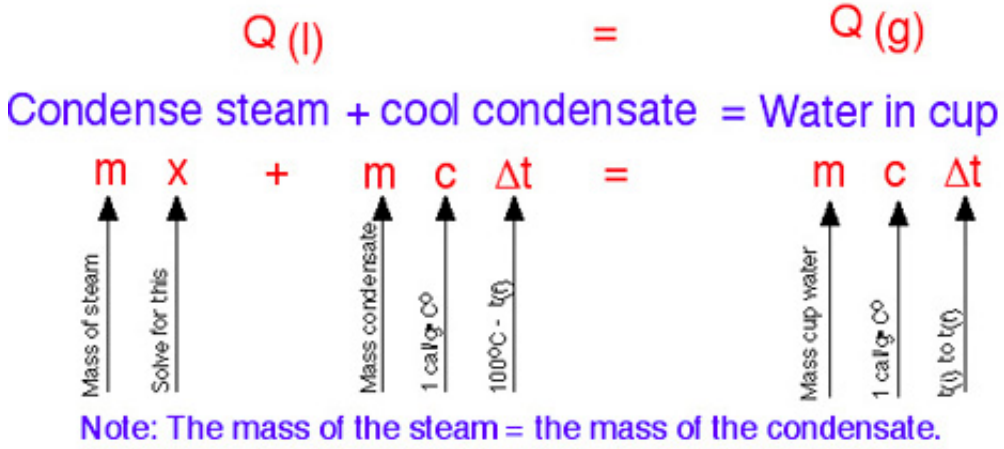
3. Calculate the temperature change, **Δt**, of the condensate from the steam. ***HINT: It started at 100° C and cooled to the final temp.*** And record it in the Calculations Table below.

Calculations Table

Mass Water in Cup g	Mass of Steam g	Δt Water in Cup C°	Δt of the Condensate C°	Calculated Ht of Vaporization cal/g	Accepted Value cal/g	Your Error cal/g	% Error
.	.	.	.	.	538 cal/g	.	.

4. Use this equation, and SHOWING YOUR METHOD (1,2,3,4) solve for the heat of vaporization. (**x**):



5. Find your percentage error. ***HINT: Percent error = your error/accepted value X 100%. The accepted value is 538cal/g/***

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Part II: THE GREAT SUCKBACK! *(Suction is the PUSH of atmospheric pressure).*

PROCEDURE:

1. With GOGS ON, shoot steam from the rubber tube into a FULL cup of cold water.

Observations:

2. Remove the burner from the flask and keep the rubber tube in the bottom of the cup of cold water. Keep watching the flask and be patient for about one minute. WOW!

Observation:

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QUESTIONS:

1. Since heat of vaporization does not result in a temperature change, where does the energy go?

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2. Why does steam burn a person more severely that an equal mass of boiling water at *the same temp.*?

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3. Why should the number of calories gained by the water and calorimeter equal those lost by the steam in condensing and cooling to final temperature?

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4. Explain the Great Suckback!

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CRITIQUE: