Name: _____ Date: _____

An expert is a man who has made all the mistakes which can be made, in a very narrow field.
--Niels Bohr

Title – Hotter all the TIme

Introduction: You are aware that many chemical reactions involve a heat exchange. Does the amount of material reacted affect the amount of heat produced in the reaction? In this activity you will test a reaction to see how heat varies with the concentration of one compound in a reaction.

Materials: graduated cylinder, $CuCl_2$, Aluminum foil, thermometer, insulating material (paper towels, packaging materials) rubber bands.

Procedures:

1. Prepare the following chemicals (show calculations where necessary)
   20.0 mL 0.10 M $CuCl_2$ (use a graduated cylinder to measure the required volume of water)
   1 strips of Al foil (0.50 g)

2. Write a balanced chemical equation for the reaction between Al(s) and $CuCl_2$(aq)

3. Determine which reactant would be the limiting the reagent if the 20.0 mL of 0.10 M $CuCl_2$ are combined with 0.50 g of Al (show calculations).

4. Add the 20.0 mL of 0.10 M $CuCl_2$ to a large test tube. Wrap a towel around the tube and secure with rubber bands. Insert a thermometer and note the initial temperature. Add the Al solid and observe the temperature change. Note the final temperature.

5. Define the system and the surroundings for the above reaction. Is the reaction endo- or exo-thermic?

6. Calculate the q for this reaction (see below if you need some help).

Calculation of heat energy: q_{rxn}

$q_{rxn} = -q_{surr} = -(m \times c \times \Delta T)$ where $\Delta T = T_{final} - T_{initial}$

m = mass of surrounding water in grams
ΔT = change in temperature of the surrounding water.
c = specific heat capacity of water = 4.18 J/g·°C

7. Make a hypothesis and then design and conduct an experiment to test the effect of increasing the number of moles of $CuCl_2$ on q_{rxn} (**Note:** total volume of reaction mixture remains constant from step 4, you will need to mix new solutions of $CuCl_2$).

Hypothesis:

Procedures:

1.

2.

3.

4.

5.

6.

7.

Data:

Moles Al	**Moles $CuCl_2$**	**mL water**	**starting temp**	**finishing temp**	**Change in temp.**	**q_{rxn}:__**	**q_{rxn}/mol of $CuCl_2$**

1. Explain why q_{rxn} /mol of $CuCl_2$ is important and not q_{rxn} /mol of Al.

2. Does the amount of material reacted affect the amount of heat produced in the reaction? Explain.

3. Was your hypothsis of of q_{rxn} /mol for this reactions is an under or over estimation? Please explain. (2 points)