Experiment 8 Post-Lab Tips
Fall 2006

For problems 1 – 3, we're looking at a situation where something hot loses heat to something cold (actually, *two* somethings cold – the water and the calorimeter). In all these cases,

heat lost by the hot stuff = heat gained by the cold stuff

Problem 1: you are given the amount of heat added, 8.412 kJ, so you can use the equation in part 6 on page 69 of the lab manual. Calculate ΔT for the water (this will also be ΔT for the calorimeter), then plug it into the equation along with the heat capacity of the calorimeter and the specific heat capacity of water (4.184 J/gK). The only variable left in the equation is the mass of the water in grams, and this is what you're solving for. Make sure you convert the 8.412 kilojoules that you are given into joules before using it in the equation.

Problem 2: This is exactly like Problem 1, except that instead of being given the amount of heat added, you have to calculate it. So the cold side of the equation will be exactly the same as what you used in Problem 1. The hot side of the equation expands to include the mass of the hot water, the heat capacity of the hot water, and the change in temperature of the hot water. This is the equation in part 7 of page 69. (Switch the sides of the equation and compare it to the equation we just used in problem 1).

The negative sign on the hot side of this equation is there because the hot side will always have a *negative* ΔT, so the negative sign in front just makes everything positive again. ($\Delta T = T_{final} - T_{initial}$, and for the hot side, $T_{initial}$ is always larger than T_{final}).

Remember that the hot side and the cold side will have two different ΔT terms!
$\Delta T_{hot} \neq \Delta T_{cold}$. For ΔT_H use $T_{final} - T_{initial}$ for the hot stuff (either hot water or metal), and for ΔT_C use $T_{final} - T_{initial}$ for the cold stuff (the water and calorimeter).

Problem 3: This problem is done exactly like Problem 2, except that we're adding hot metal instead of adding hot water, so we need the specific heat capacity of the copper metal. It's in the table on page 65. This one is a little trickier because you have to calculate T_{final}. Just set up the equation the same way you did with problem 2, but instead of ΔT, enter ($T_{final} - T_{initial}$). Remember that you will have a different $T_{initial}$ for the hot side than you will for the cold side. $T_{initial:hot}$ = 98.0 °C, and $T_{initial:cold}$ = 20.3 °C.

If you plug in all the information given, you will have a value for every variable except T_{final}. T_{final} is the same for both sides. Do the algebra carefully! It will be a fairly small increase in temperature.

Problem 4: The *molar heat of formation* means you are forming CH_4 from its component elements, so the only thing you can have on the right side of the equation is CH_4, and the only thing you can have on the left side are carbon and hydrogen in their elemental forms ($C_{(graphite)}$ and $H_{2\ (gas)}$). So the first and third equations will not be reversed – CH_4 and $C_{(graphite)}$ are already right where we want them. And since this is *molar* heat of enthalpy, make sure you calculate the amount of heat *per mole* of CH_4 formed. Make sure that *whatever you do to the chemical equation, do the same thing to the* ΔH. If you multiply an equation by 2, multiply the ΔH by 2. If you reverse the equation, change the sign on the ΔH.

Problem 5: You're doing the same thing here that you did in problem 4. Make sure you find the *molar* heats of formation for both Fe_2O_3 and for Fe_3O_4.