Preliminary Project Design Calculations (Rev 7/5/13)

1 .Calculate the heat required to raise the temperature of the 100 mL of water

2. Calculate the heat released per g for **all** candidate salts. Express in a table with the following headings

Table 1 (Heating Criteria)

Salt Name/Formula	Molar Mass (g/mole)	Heat of Dissolution ΔH(soln) (KJ/mole)	Heat released/g of salt J/g	g salt required to increase temperature of 100 ml water 10ºC

3. Determine the full criteria for selection of the salt. Find quantitative information for these criteria for each salt (that qualifies based on Table 1 data). Express this information in a table.

Table 2. (Other Criteria)

Salt Name	Criteria 2	Criteria 3	Criteria 4	Further Criteria

4. Use a Pugh Chart (with weighing factors) to evaluate the salt candidates and make a selection.
   (Each salt on the available list must be considered. A decision must be made, even with incomplete information.)

   Include a brief reason for rejecting candidates.

4.   Determine selection criteria for container material and size.
       a.   Brainstorm a container design and materials

5.   Make a drawing for the first prototype

Equipment Sizing (Rev 7/7/13)

Refine the equipment design:

Specify the actual containers (size and material) that you will use. These containers can be brought from available equipment in the laboratory or brought from home. The group must have the equipment in hand (and inspected by the teacher) before proceeding to the next steps.

Determine the volume of water required in the salt container.

Estimate the final temperature required in the salt container order to transfer the required amount of heat.

> This estimate requires resourcefulness both in your background research and analysis. For example, you know that a temperature difference between the containers (ΔT) is required for heat to flow and that the rate of flow of heat through the container wall depends upon its material of construction.

Calculate the amount of salt required for your full apparatus. Be sure that your entire group reviews this calculation

Procedure
> List precisely the steps as you plan to do them
> List all safety precautions

Hand in Summary, procedure, including a diagram (Refer to the handout). Document the reasoning and resourcefulness carefully.

Final Check of Calculations/Containers/Heat Loss Estimates (Revision 7/8/13)

Show all details of calculations clearly on a separate sheet of paper and hand in with this sheet.

Recheck Critical Calculations: The amount of salt released/g of salt is a crucial calculation and needs to be **checked independently** to be sure it is correct. Note that the some of the salt forms available are hydrates. The molar masses of the hydrates are shown below.   The other columns should be completed and checked for your selected salt.

Recalculate the heat released of your selected salt. This is a crucial calculation. Check the calculation from the beginning to be sure that it is correct.

Salt Name/Formula	Molar Mass (g/mole)	Heat of Dissolution ΔH(soln) (KJ/mole)	Heat released/g of salt J/g	g salt required to increase temperature of 100 ml water 10ºC

Containers:

Confirm experimentally the working volume of water in the outer container: _____mL

Calculate the minimum amount of heat that must be generated to heat
the water in the outer container: _____ J

Calculate the total minimum quantity of salt required for the entire system: _____
(Include the heat required for both the salt water and medicine (100 mL pure water.)

Additional Salt for Estimated Heat Losses and Inefficiencies:

Additional heat is required for two reasons:
* A temperature difference (ΔT) between the two containers is required in order to transfer heat from the salt solution to the pure water
* Heat is lost from the system to the environment.

Use your resourcefulness to make an estimate of the heat losses. Base your thinking on your own physical experience, then make a quantitative estimate. Again show the reasoning and calculations on a separate sheet.

Estimated heat losses: _____   Additional Salt required: _____

Total Salt required: _____