I. Energy and Heat

A. Definitions:
   1. Temperature
   2. Heat:
      a. (temperatures temperatures)
   3. System:
   4. Surroundings:
   5. Measuring energy:
      a. Units: or
      b. 1 cal = 4.184 J
      c. is a difference in energy

II. Specific Heat

A. Specific Heat (c or \(c_p\)):
   Units: \(\text{Water:} \text{ } \) 
   1. Good heat conductors have
   2. Equation to determine heat transfer: or
      a. 
      b. 
      c. 
         i. 
   3. Example: How much heat (in kJ) is needed to warm 250.0 mL of water from 25.0°C to 95.0°C. (1g water=1mL water)

   4. Example: 2010 calories of heat is added to 50.0g of water. If the temperature of the water was initially 25.0°C, what is the final temperature?

B. Measuring Heat Transfer
   1. insulated container caused by another object.
   2. Heat of the reaction is
   3. Thus, you can measure the heat of a reaction by
   4. 

5. Example: A calorimeter contains 100.00 g of water at 22.4°C. A 75.25 g sample of Al at 99.3°C is placed in a calorimeter. The substances reach a final temp of 32.9°C. Find the specific heat of Al.
A. Phase Change
1. Energy is used to involved.
2.
3.
4.
5.

B. 1. from the surface of the liquid and
   a.
   2. a. Molecules of vapor become liquid by
      b. Liquid molecules that
      c. In a closed container, the will eventually become (more gas particles present).
   3. a.
      b. as
   4. Boiling Point:
      a.

C.
1. Freezing point:
2. Melting point is the
3. Not affected by external pressure.
4. FYI:

D.
1. Sublimation:
   a. Examples:
   b. In this case,
2. Deposition:
   a. Ex:

IV. Energy changes during a change of state
A. During a change in state, the
B. You can calculate it using the following equations:
   1. Between the solid and liquid phases, use:
      a.
      b. ( = 334 J/g or 80.0 cal/g)
      c. Since freezing is for freezing.
   2. Between the liquid and gas phases, use:
      a.
      b. ( = 2260 J/g or 540 cal/g)
      c. Since condensing is for condensing.
A. Every substance has different:
   1.
   2.
   3.

B. Graphs are used to show phase changes

C.  
   1. Plots \((y\text{-axis}) v. (x\text{-axis})\)
   2. You can label the phases and phase changes based on the slopes!
      a. \((\text{when heating})\)
      i.
      b. \((\text{when heating})\)
      i.
      c. For cooling, it’s the opposite!

D. PUTTING IT ALL TOGETHER!!!
   1. If the temperature change includes a phase change, include energy of the phase change in the calculation
      a. Find the steps that you need to take (how many times does the slope change?)
      b. Calculate \(q\) for EACH step!
      c. Add them together!
   2. Example: How much energy is required to change 30.0 g of water vapor at 109°C to water at 28.0°C?
      How many steps are there? \((c_{\text{steam}}=2.01 J/g°C \text{ and } c_{\text{ice}}=2.03 J/g°C)\)
VI. Thermochemistry

A. Thermochemistry: the study of

B. \[ \Delta H \] depends on the initial and final enthalpy.

1. Exothermic reactions:
   a. NOTE:

2. Endothermic reactions:

C. What else changes in a chemical reaction?

1. 
   a. 
   b. The universe tends to
   c. If something becomes

D. : reactions that

E. 

1. Uses enthalpy and entropy to do so.

2. 

3. 

Table:

<table>
<thead>
<tr>
<th>Thermodynamic Quantity</th>
<th>Positive (+) means...</th>
<th>Negative (-) means...</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>