Shannon,
If possible, please send me the web address for the chemistry website. That will help me with getting notes and clearer information to you.

September 4, 2003

Information is on the board.
Handouts;
Announcements;
Supplemental instruction will not have a session today.

Teacher: write down times, as they change from time to time. More information is available on Tuesday. Your "turn ins" have no formal due dates, but you’ve been really good about these. (Reading from page on board).

Sunday’s review; they have started locking the building due to transients living there, in what is my office. The handicapped entrance will be propped open. We will discuss what you need from 101, trig, and math…

Female Student: what time?

Teacher: 2pm in this room.

In class, I will have these here posted for late arrivals, but announcements are at the front of class. We have a new stockroom guy, just here… He is the building proctor too. We ask that you help keep the room clean. Any questions?
Chapter 15; thermodynamics

Today is the introduction to the whole concept of chemical thermo. I use my notes from the web as a guide but sometimes I will use different examples. You might want to copy my notes then add in your notes. Figure out your learning style… This material is not easy. We go in order of the chapters and end with organic chemistry.

Look at the word and you can get an idea of what this chapter is about. **Thermo** is heat energy and **dynamics** is movement. Before we dealt with mass and moles now, we will look at heat and movement and adding to what we know. We will be looking at **the study of energy transfer and energy changes that accompany physical and chemical processes**. From chapter 13, we had heat of fusion (Example on board.). *How much heat was required to raise 10g of ice from –10 C to 110 C?* There were many steps. Even though we didn’t figure the heat before, now we will.

Chemical changes involve energy changes and can be calculated from tables in the back of the book, App. K. The information you can get from the tables:

1. Will 2 or more substances react? If there is a reaction, rxn, then it is **spontaneous**.
2. When and if they react, we can figure the heat released **exothermic** or energy that is absorbed **endothermic**.
This is called enthalpy change (deltaH.). These do have sign conventions. He is released, exothermic, -; if heat is absorbed, endothermic, +. \( ^\Delta H = -232 \) you know its an exothermic reaction. The size of the number does not give you the speed, or how fast the reaction happens. This is in the next chapter under chemical kinetics. The mechanism of the reaction is also in the next chapter.

(Example on board.) These balloons are not filled with helium, but hydrogen. 2 have H and 2 have HO. Lets look at the rxn. To write out, it’s a simple reaction. (Example on board.) \( 2h_2(g) + o_2(g) \rightarrow 2h_20(l) \)

Looking at that, is it exothermic or endothermic? Don’t know, but in \( \text{your heart you know.} \) *If I put a match to it, what is the reaction…?*  (Example on board.). Hydrogen was okay and had a big ball of fire, meaning exothermic. That was with H only; the oxygen was from the room… After the mixing in the air, the ball was big.

Now in this one they are mixed… the ball of fire was smaller, because the oxygen was already there and the reaction was faster. Now look again at the reactions. Here is another balloon with pure oxygen; it’s more dense than air… The density of a gas is related to m/v and the amount of molecular weight. Look at the chart (Example on board.) *how do the 2 vary?* Its mostly nitrogen, oxy has more weight than 70% n and 30%o…
(Example on board.) If I had lit it, {Laughter!}, it would have popped… Oxygen is not flammable… Why? Is it a fuel? No! Hydrogen and wood and methane are fuels. Its necessary for a fire, but nothing will happen… It does help things burn better…

Lets look at another demonstration. (Example on board.) Ba(OH) + 8H2O… Is this acid base or salt? Strong or weak? These are from chapter 4. That formula with NH4SCN with a if its put in water then you get 1 you have a salt and base, then you know they must have equal numbers. Ba combines with SCN so its +2, then it must have scn2 and its (aq). That becomes ammonium 2nh3(g).

This is 107, but I expect you to know it…

Lets try to figure the oxidation numbers of water, h2o, its O –2 and the H is +1, it must add up to 0… They need 2 more electrons to be a noble gas. The electro negativity can be gotten from the table. (Example on board.) N is 3pnt0 and 2pnt1. N has the bigger number. For the compound to be neutral, it must add up to 0.

In the above example, this is not a redux reaction, so this reaction goes because we are removing ions, forming water and ammonia.
Lets look at this reaction… (Example on board.); beaker, water, and a board. I am putting 2 solids in there and mix. It’s getting slushy from 2 solids… The water attached as a solid is coming out… anyone want to smell? Its smells of ammonia, like smelling salts… Now, come back up and feel the beaker… It’s cold.

Now, the reaction is going and feels cold. This reaction is endothermic or absorbing heat. It feels cold, because the reactions sucks heat from your hand. The reaction needs heat to go. Is it spontaneous? Yes, because it’s going, but it’s endothermic. It takes heat from the environment, his hand or the room. It took so much heat, it froze it, (Example on board.) and the beaker froze to wood. It didn’t freeze the water in the solution because it wasn’t pure water.

The concepts we are working with is a **system**. The system plus the surroundings equals the universe. The **system** is all the substances involved in chemical and physical changes going on, including the **reactants** and the **products**. The surroundings are everything else, including the beaker, board, water, room, you and Houston.
The system took the heat from surroundings, in this case; heat plus reactants (to go). It’s written like this (Example on board.). The energy of the universe stayed the same. The heat was being transferred from surroundings to the system. That is the **first law of dynamics**; the total amount of energy in the universe is constant. Energy also includes energy in mass, $E=mc^2$.

**Lets learn some def and terms:**
Thermodynamics state of system: defined by a set of conditions that completely species all properties of system including temperature pressure composition and physical state; (g) gases, (l) liquids, (s) solids, (aq) aqueous (dissolved in water).
State function: props of a system; examples are Pressure, Temperature, Volume. The value of state function depends only on state of system and NOT on how the state is reached. It is designated by a capital letter. The first part of the statement means (Example on board.) that if in an example we had: $T$: $20\degree C \rightarrow 30\degree C \rightarrow 22\degree C$; it’s the beginning minus the end… And get the change of temperature, which would be $2\degree C$. $T=T$ (final) - $T$ (initial).
State functions are important because they allow us to do math.

1. We assign values to a few state functions, and then we can calculate the rest. Example: \( PV = n \ RT \).
2. When the state of the system changes, the change of a state function depends only on initial and final state, NOT on how the state was reached.

**Work** \( w \) equals force \( \times \) distance, but it is not a state function because it depends on distance and the path you take. **Internal energy** \( E \) is the sum of all internal energies of a specific amount of a substance. Kinetic energy of molecules and the bonding energy. Units of this is kJ/mol

**Enthalpy**, \( H \), is the total heat content of a specific amount of substance and is exothermic if the heat of released (-) or endothermic if the heat is absorbed (+). Units are kJ/mol.

**Entropy**, \( S \), is disorder and measure of randomness of system. The units here are J/mol (x) K.

**Gibbs free energy**, \( G \), indicates amount of energy available for a system to do useful work. \(-\delta G\) the rxn is spontaneous and \(+\delta G\) then the rxn is non spontaneous and reverse rxn is spontaneous. Is \( \delta G = 0 \) then the rxn is in equilibrium…