CHEM 3410
Test #2
This study aid is, of course, *NOT all inclusive*. Its goal is to give you a starting point from which to study.
Information that you will have at your disposal:
-Periodic table, scratch paper, various information such as ΔH and ΔS tables, etc. that are necessary

The make-up of the test: multi-match, short-answer, discussion, short and long problems

Skills to master for any chapter:

- Understand the "big picture" concept.
- Understand practical uses (both in chemistry and in non-chemistry real life) of w, q, and ^U.
- Be able to discuss graphs and figures within the chapter. (This aids your understanding of what's physically or chemically happening within the system.)
- Be able to work problems with all formulas presented in class.

Suggested Study problems… the test:
Ch. 2
Exercises: 2.18b, 2.21b, 2.22a ("a" part only), and 2.24

Ch. 3
Exercises: 3.1a, 3.3a (HW), 3.4a (HW), 3.6a (HW), 3.7a (HW), 3.13a, 3.15a (HW)
Problems: 3.1 (only the ^S-system, not ^S-surroundings or ^S-total), 3.6

Chapter 2 (Remainder) Outline/Study Aid **The First Law**

Heat Capacity (the formal definition) $C_V = \left(\frac{\partial U}{\partial T}\right)_V$ (good pictorial representation) (This material was on the first test, so you won't have to know specifics. But you do need to be able to compare the two graphs of U vs. T and H vs. T.)
C_V for *monatomic* perfect gas **derivation**
The text's introduction of specific heat
Derivation of $q = C\Delta T$
Conditions, assumptions

$\Delta U_T = 0$ and $\Delta U_U = 0$ for an ideal gas at constant temperature. The reason for this fact was discussed in class and has to do with $\left(\frac{\partial U}{\partial V}\right)_T = 0$.

Enthalpy

(a) The definition (formal) of enthalpy

$$H = U + pV$$

$\Delta H = q_p$ when p is constant and when no *additional* work occurs

(**Derivation**—won't be asked to reproduce but do need to work through it for understanding.)

(b) The measurement of an enthalpy change

(c) The variation of enthalpy with temperature, aka constant-pressure heat capacity

$$C_p = \left(\frac{\partial H}{\partial T}\right)_p$$

Assumptions as to when you can use Cp

(d) The relation between heat capacities for an ideal gas Cp-Cv = nR

The "big picture" of comparison of temperature change at constant p vs. constant V and C_p vs. C_V

(e) Direct and indirect methods to calculate ^H.

Chapter 3 Outline/Study Aid **The Second Law: The Concepts**

Intro
Spontaneous Change
The direction
What determines spontaneity
Predictions of spontaneity

3.1 The dispersal of energy

3.2 Entropy

(a) The thermodynamic definition of entropy $$dS = \frac{dq_{rev}}{T}$$

P. 3 and the list of equations for entropy

(b) Entropy as a state function
Carnot cycles
Engines
Refrigerators

Efficiency $$\varepsilon = \frac{w_{cycle}}{q_{hotsource}} = \frac{q_{hotsource} + q_{coldsource}}{q_{hotsource}} \qquad \varepsilon = 1 + \frac{q_{coldsource}}{q_{hotsource}} = 1 - \frac{T_{coldsource}}{T_{hotsource}}$$

Coefficient of performance $$c = \frac{heat\_transferred}{work\_done} = \frac{|q_{cold}|}{|w|} \qquad c = \frac{T_{coldsource}}{T_{hotsource} - T_{coldsource}}$$

(c) The thermodynamic temperature

Lord Kelvin and $$\frac{q_{hotsource}}{q_{coldsource}} = -\frac{T_{hotsource}}{T_{coldsource}}$$

3.3 Entropy Changes Accompanying Specific Processes

(a) The entropy of phase transition at the transition temperature

$$\Delta S_{transition} = \frac{\Delta H_{transition}}{T_{transition}}$$

(b) Expansion of a perfect gas

$$\Delta S = +nR\ln\frac{V_f}{V_i}$$ derivation

Change in entropy of universe: 1) reversible 2) free expansion

(c) The variation of entropy with temperature derivation

$$\Delta S_{total} = \Delta S(p) + \Delta S(T) \quad \text{or} \quad \Delta S_{total} = \Delta S(V) + \Delta S(T)$$

$$\Delta S(V) = C_p \ln\frac{T_{final}}{T_{initial}} \quad \text{or} \quad \Delta S(p) = C_V \ln\frac{T_{final}}{T_{initial}}$$

(d) The measurement of entropy
Didn't really cover this material so not on test.

3.4 The Third Law of Thermo

(a) The Nernst heat theorem