Chem 12 **Reading and Homework set 5**

Read Ch 9 intro and sections 9.1, 9.2, 9.4, 9.5, 9.6 (note the exclusion of section 9.3). We'll be focusing more on the later of these sections in class first, then returning briefly to the more difficult concepts of E vs H and "work". You may find sections 9.7 and 9.8 interesting as well, though this material doesn't really lend itself to the creation of good exam questions.

Note that for Hess' law calculations, the units should be kJ/**mol**… well… kJ per *n* moles where *n* is the balanced equation coefficient of whatever species we're interested in…. this little complication is the reason that Zumdahl decided to use "kJ". How about "kJ per mol of reactions as written"?

Not for credit —

A. Ch 9, problems — 29a,b, 39, 41, 43, 47, 51, 64, 71

To be turned in for credit
20 points; due Wed, March 9 at the beginning of class.

1. Ch 9, problems — 40, 44, 48, 54, 70

2. (a) Ch 9, problem 65. (b) Also calculate the enthalpy change per mol of N_2O_4 (rather than per 5 moles, as the equation is written). (c) So how much heat is that?! If the heat produced by reaction of 1 mol (92 g) of N_2O_4 with methylhydrazine could be transferred to water with 100% efficiency, what mass of water could be heated from room temperature (25 °C) to 100 °C? Assume that the specific heat capacity of water, 4.184 J g^{-1} $°C^{-1}$ is appropriate over the full temperature range.

3. The NIST website has an excellent compilation of thermochemical data. Let's find some data for benzene. Go to webbook.nist.gov. On the second line, you'll find a link to "NIST Chemistry WebBook" — click on that, then under "General", click on the "Formula" link.

1. Enter *C6H6* in the formula box. 2. Check "Exclude ions..." 3. SI (i.e., we want Joules, not calories). 4. Under thermodynamic data, you can check whatever you want... I suggest at least the first three boxes. "Search" will give you a list of all the C_6H_6 isomers for which data are available. Pick benzene, and you'll get a bunch of data tables, from which you should be able to find enough info to answer the following questions (no need to include error limits).

a What are the most recent values listed for $\Delta H°_f$ for gas and for liquid benzene?
b The difference between these is $\Delta H°_{vap}$, the enthalpy change associated with vaporization. Calculate this value. How well does this agree with the value listed under "Phase change data"?
c What is the specific (constant-P) heat capacity of liquid benzene at 25°C? Use the most recent value. You may need to do a unit conversion.
d What is the most recent value reported for benzene's boiling point, in °C?