**Ch 7 Thermochemistry Name:**

*7.1 Chemical Hand Warmers*

What solid is produced during the hand warmer rxn? (What is the common name for this product?)

Is this really the useful product? Explain

*7.2 The Nature of Energy: Key Definitions*

What is energy?

work = force x \_\_\_\_\_\_\_\_\_\_\_\_ *(remember force = mass x acceleration)*

Energy can either be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ *(Figure 7.1) What is chemical energy (a form of*

*\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy) associated with?*

What is the law of conservation of energy and what “can” energy do?

Energy transfers between the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ and the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_s. (The exchange is EQUAL.)

KE = \_\_\_\_\_\_\_\_\_\_ (m in \_\_\_ and v in \_\_\_\_\_) 1 joule = \_\_\_\_\_\_\_\_\_\_\_\_ 1 calorie = \_\_\_\_\_\_\_ J

*(Note: a calorie is defined as the amount of heat need to raise the temperature of 1 g of water 1oC and food* ***C****alories are actually kilocalories 1000cal = 1Cal)*

*7.3 The First Law of Thermodynamics: There is No Free Lunch*

What is the 1st law of thermos?

What is internal energy and what does it mean to say it is a state function?

*Change in altitude is a good example. The path does not matter: the change from top to bottom is the same.*

*Internal energy helps to define the sign of energy flow: - is out and + is in. (Figure 7.5)*

*CC7.1 \_\_\_\_\_ CC7.2* \_\_\_\_\_ *Practice 7.1*

*7.4 Quantifying Heat and Work*

What is the distinction between heat and temperature?

*Note the distinction between heat capacity (C) and specific heat capacity (Cs or Cp). Water has a specific heat of 4.184J/1g•1oC. A bucket of water has a much larger heat capacity than a cup of water due to the overall mass so heat capacity is an EXTENSIVE property. Specific heat capacity and molar heat capacity are INTENSIVE.*

Write the formula for calculating heat (q):

*Practice 7.2 (rearrange the formula to solve for Cp) More Practice 7.2 (find ΔT then determine Tf)*

Cp = ΔT =

*CC7.3 \_\_\_\_*

Another way to write *qsys = -qsurr*  is *qsys + qsurr* = 0. (heat lost by system is gained by surroundings and vice versa)

*Practice 7.3*

*CC 7.4 \_\_\_\_*

*Work: Pressure-Volume Work*  This section shows how the expansion of gas can be used to do work. In AP chemistry most of our problems are done at constant volume or pressure and the work is zero.

*7.5 Measuring ΔE for Chemical Reactions: Constant-Volume Calorimetry*

Since the change in internal energy ΔE for a system is heat + work, when work is zero ΔE = q.

Bomb calorimeters can be used to precisely measure the heat of chemical reactions (esp. combustion).

Write the formula used for calculation heat absorbed by the calorimeter: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

*(Note mass is not needed because you are using the heat capacity of the entire calorimeter Ccal)*

*Practice 7.5*

*7.6 Enthalpy: The Heat Evolved in a Chemical Reaction at Constant Pressure*

What is enthalpy (H)?

Why is the change in enthalpy ΔH for a reaction equal to the heat at constant pressure qp?

What is the difference between endothermic and exothermic? What signs are used?

*Practice 7.6 (use endo or exo and – or +) a)\_\_\_\_\_\_\_\_\_\_\_ b) \_\_\_\_\_\_\_\_\_\_ c) \_\_\_\_\_\_\_\_\_\_\_*

Read *Endo & Exo Processes: A Molecular View CC 7.7 \_\_\_\_*

ΔHrxnis the \_\_\_\_\_\_\_\_\_\_\_\_\_\_ or \_\_\_\_\_\_ of reaction and is an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ property(depends on \_\_\_\_\_\_\_\_\_).

The \_\_\_\_\_\_\_\_\_\_\_\_\_ is for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ amounts of reactants and products for the reaction as written.

*AP uses the designation ΔHmolrxn in many problems. CC 7.8 \_\_\_\_*

*Practice 7.7*

*More Practice 7.7*

*7.7 Constant-Pressure Calorimetry: Measuring ΔHrxn*

We will use a set-up similar to *Figure 7.9* in lab. Write the equation for finding heat absorbed by the solution.

In this example we assume that no heat is absorbed by the calorimeter qsoln=

therefore qrxn= −qsoln *(or sum of q’s = 0)*

*Notice at the end of Example 7.8 the ΔH is calculated per mol of Mg since the coefficient in the rxn is 1 therefore the answer could be written as -4.6 x 105J/molrxn (of course this value would correspond to 2 mol of HCl).*

*Practice 7.8 (Notice: most dilute solutions have approx. density of water 1.00g/mL and Cp = 4.18J/1g•1oC)*

*7.8 Relationships Involving ΔHrxn*

Note: relationships #1 and #2 are used in conjunction with #3(Hess’s law) to determine *ΔHrxn* without directly

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ it in the laboratory. Read the example in the text and Example 7.9 *CC7.10 \_\_\_*

*Practice 7.9 (Suggestion: write the overall rxn below a line as shown below to guide your work)*

N2O*(g)* + NO2*(g)* → 3NO*(g)* *ΔH =*

*7.9 Determining Enthalpies of Reaction from Standard Enthalpies of Formation*

Note the definition of standard state conditions used to determine standard heat of formation *(ΔHof).*

For pure compounds the formation value is for \_\_mole from its \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in their standard states and

pure elements have *ΔHof = \_\_\_\_. (More complete list than Table 7.5 is in Appendix IIB.)*

Note *Example and Practice 7.10* show balanced equations written to produce 1 mole of product *(some reactants will have fractions instead of whole numbers).* The next section shows how Hess’s law can be used to develop an equation to use enthalpies of formation to calculate *ΔHorxn*.

*Practice 7.11*

*7.10 Energy Use and the Environment*

This is a good overview of our energy sources and some of the issues related to the use of fossil fuels.

*Chemistry in the Environment: Renewable Energy*

*Exercises*(pgs 302-306) # 35, 41, 45, 47, 59, 65, 73, 76, 79, 81, 89, 91, 101, 102, 105, 109