Supplemental Instruction
CHEM 115a
Professor Reisler

Tiffany Sia
tsia@usc.edu
www.usc.edu/si

Sheet 4.1 (11/2-11/9)

1. Thermochemistry Equation Review

	Constant Pressure	Constant Volume
Specific heat constant		
ΔH		
ΔU		

2. Calorimetry:

a. **Constant pressure calorimetry:** Enthalpy

b. A piece of copper (c_{Cu}=0.385 J K^{-1} g^{-1}) at 700. K is placed in 0.85 kg of water at 283 K (c_w=4.18 J K^{-1} g^{-1}) and the temperature of the combined system was measured as 350 K. What was the mass of the copper?

c. **Constant volume calorimetry**: Is there work being done?

d. A sample of solid benzoic acid (C_6H_5COOH) that weighs 0.800 g is burned in an excess of oxygen to form CO_2 (g) and H_2O (l) in a constant-volume calorimeter at 25°C. The temperature increase is observed to be 2.15°C. The heat capacity of the calorimeter is 9382 J K^{-1}.

   i. Write a balanced equation for the combustion of 1.00 mol of benzoic acid

   ii. Calculate the standard change in internal energy for the combustion of 1.00 mol benzoic acid to CO_2 (g) and H_2O (l) at 25°C.

   iii. Calculate the standard enthalpy change ($\Delta H°$) for the reaction in part b.

Tiffany Sia
tsia@usc.edu
www.usc.edu/si

iv. Calculate the standard enthalpy of formation per mole of benzoic acid, using data from the following table:

Compound	Enthalpy of formation (kJ/mol)
CO_2 (g)	-394
H_2O (l)	-286
C_6H_{12} (l)	-269

3. **Enthalpies of reactions:**
   e. What are the standard states:
      i. Gas:
      ii. Liquid/Solid:
      iii. Solute in solution:

4. Hess's Law:

$A + B \rightarrow C + 2D$	-360. kJ/mol
$2C + E \rightarrow F$	-116 kJ/mol
$E + B \rightarrow D$	893 kJ/mol
$2A \rightarrow F + 2D + E$	$\Delta H = ?$

$2\ O_3\ (g) \rightarrow 3\ O_2\ (g)$	-427 kJ/mol
$O_2\ (g) \rightarrow 2\ O\ (g)$	+495 kJ/mol
$NO\ (g) + O_3\ (g) \rightarrow NO_2\ (g) + O_2\ (g)$	-199 kJ/mol
$NO\ (g) + O\ (g) \rightarrow NO_2\ (g)$	$\Delta H = ?$

5. **The Photoelectric Effect**: A 10-watt laser shines a beam of light with a wavelength of 745 nm. (1 W = 1 J/s)
   a. What color is the beam of light?
   b. Find the energy of each photon of light.

   c. Calculate the number of photons of light emitted per second.

6. **The Bohr Model**:

Supplemental Instruction
CHEM 115a
Professor Reisler

Tiffany Sia
tsia@usc.edu
www.usc.edu/si

d. A unit of quantized light energy is called a _____

e. The constant used in the Bohr model is called the _____ constant

f. If H^+ has an electron with energy of -2.42×10^{-19} J, at which energy level does this electron exist?

g. If this electron were to jump to -2.18×10^{-18} J, what type of EM radiation would be emitted?

$$E_n = -R_y\left(\frac{1}{n^2}\right); R_y = 2.18 x 10^{-18} J$$