

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 ($c_{\text{Cu}}=0.385 \text{ J K}^{-1} \text{ g}^{-1}$) at 700. K is placed in 0.85 kg of water at 283 K ($c_{\text{w}}=4.18 \text{ J K}^{-1} \text{ g}^{-1}$) 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 ($\text{C}_6\text{H}_5\text{COOH}$) 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 (ΔH°) for the reaction in part b.

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

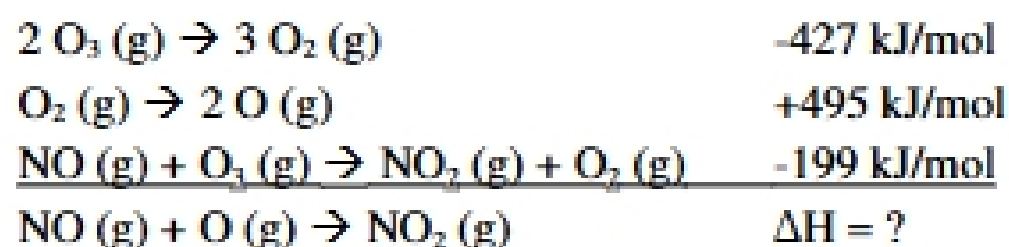
Compound	Enthalpy of formation (kJ/mol)
CO ₂ (g)	-394
H ₂ O (l)	-286
C ₆ H ₆ (l)	-269

3. **Enthalpies of reactions:**

- e. What are the standard states:

- i. Gas:
- ii. Liquid/Solid:
- iii. Solute in solution:

4. **Hess's Law:**



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:**

- 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?

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