

Outline for Today

Friday, Oct. 12

- Chapter 5: Thermochemistry
 - Constant Volume Calorimetry
 - Hess's Law
 - Enthalpy of Formations
 - Thermochemistry of Fuels

Example: Constant Pressure Calorimetry; Determining ΔH_{rxn}

- When **10.0 g** of H_2O_2 (l) decomposes into **water** and **oxygen** gas in a constant pressure calorimeter with a C_{cal} of **400.0 J/K**, the temperature increases by **72 K**. What is the balanced chemical reaction and the Enthalpy of the reaction?

Example: Constant Volume Calorimetry

- What would the expected **temperature change** be in a *bomb calorimeter* ($C_{\text{cal}}=5.431 \text{ kJ/K}$) if **2.0 g** of methane is combusted?
- $\text{CH}_4 (\text{g}) + 2\text{O}_2 (\text{g}) \rightarrow \text{CO}_2 (\text{g}) + 2\text{H}_2\text{O} (\text{l})$ $\Delta E_{\text{rxn}}=-883 \text{ kJ/mol}$

ΔH°_f Tabulated Data

a. $\text{CO}_2(\text{g})$: -393.5 kJ/mol

b. $\text{H}_2\text{O}(\text{l})$: -285.3 kJ./mol

c. $\text{H}_2\text{O}(\text{g})$: -241.8 kJ./mol

d. $\text{C}_9\text{H}_8\text{O}(\text{s})$: -384 kJ/mol **

e. $\text{CH}_4(\text{g})$: -74.87 kJ/mol

f. $\text{C}_8\text{H}_{18}(\text{l})$: -252.1 kJ/mol

a. $\text{NH}_4^+(\text{aq})$: -132.81 kJ/mol

b. $\text{NO}_3^-(\text{aq})$: -206.70 kJ./mol

c. $\text{NH}_4\text{NO}_3(\text{s})$: -365.20 kJ/mol

d. $\text{C}_8\text{H}_{18}(\text{l})$: -252.1 kJ/mol

****This is an estimate. Data not tabulated elsewhere**

Example: Constant Pressure Calorimetry; Determining Mass of Reactant

- **10. g** of ammonium nitrate ($\Delta H_{\text{soln}} = \text{[redacted]} \text{ kJ/mol}$) is dissolved in water in a calorimeter with unknown C_{cal} and the temperature changes from **300. K** to a final temperature of **297.33 K**.
- In a separate experiment with *the same calorimeter*, an unknown mass of ammonium nitrate is dissolved into the water and the temperature decreases by **18.7 K**. **What is the mass of ammonium nitrate dissolved?**

Example: Constant Pressure Calorimetry; Determining Mass of Reactant

- **10. g** of ammonium nitrate ($\Delta H_{\text{soln}}=25.69 \text{ kJ/mol}$) is dissolved in water in a calorimeter with unknown C_{cal} and the temperature changes from **300. K** to a final temperature of **297.33 K**.
- **What is C_{cal} of the calorimeter?**
- In a separate experiment with *the same calorimeter*, an unknown mass of ammonium nitrate is dissolved into the water and the temperature decreases by **18.7 K**. **What is the mass of ammonium nitrate dissolved?**