AP Chemistry Prep Session
Saturday, December 5, 2009

John I. Gelder
Department of Chemistry
Oklahoma State University

John.gelder@okstate.edu
http://intro.chem.okstate.edu

THERMODYNAMICS

Calorimetry and Enthalpy

LAWS OF THERMO

- Zeroth Law:
  - Heat flows from hot to cold
- First Law:
  - Energy and matter are conserved
- Second Law:
  - Matter tends towards chaos
- Third Law:
  - Entropy of a pure crystal at O K is zero

ENTHALPY

- Heat and temperature
- Heat, amount of substance and ΔT
- Endothermic (+) or Exothermic (-)
- Calculate:
  - Calorimetry
  - Table of standard values
  - Hess's Law
  - Stoichiometry
  - Bond energies

Heat and Temperature

Molecular Workbench activity

http://workbench.concord.org/database/activities/308.html

Heat – the sum of all of the energy in a system.

Temperature – the average kinetic energy of the particles in the system.

Heat, amount of substance and temperature change

Do the Before Class Activity

http://genchem1.chem.okstate.edu/BCEActivities/Personal/PLE15.php

G1

Calorimetry: Constant Pressure

$q_{hot} = -q_{cold}$

$q_{metal} = -q_{water}$

$q_{soln} = -q_{water\ and\ solute}$

$q_{rxn} = -q_{solution}$

If the heat capacity of the calorimeter is given have to include the heat absorbed or released by the calorimeter.

q = mass * specific heat * ΔT

G2 – G16

Heat Flow: Solution Process

Look at simulation

http://genchem1.chem.okstate.edu/BCEActivities/Personal/PLE17.php

Calorimetry: Bomb Calorimeter

$q_{rxn} = -(q_{water} + q_{calorimeter})$

$q_{water} = mass_{water} * specific\ heat_{water} * \Delta T_{water}$

$q_{calorimeter} = heat\ capacity_{calorimeter} * \Delta T_{calorimeter}$

$\Delta T_{calorimeter} = \Delta T_{water}$

G17

Predicting exothermic or endothermic reactions

- Enthalpy - ΔH
  - Energy content + endo **- exo**

G18 – G22

Units on ΔH°

Enthalpy has units of

kJ mol of reaction^{-1}

Units are important!

Formation Reactions

Elements in their standard state forming 1 mol of product in its standard state.

G23

Hess' Law

State function use to determine ΔH° for new reactions.

G24 – G28

Enthalpy of reaction

$\Delta H^\circ_{rxn} = \Sigma m \Delta H_f^\circ(\text{products}) - \Sigma n \Delta H_f^\circ(\text{reactants})$

G29 – G40

Bond Energy

$\Delta H^\circ_{rxn} = \Sigma m BE(\text{reactants}) - \Sigma n BE(\text{products})$

G41 – G42