5.3 Representing Enthalpy Change

Method 1: Thermalchemical Equations with Energy Terms

- Enthalpy change is included in the balanced chemical equation.
- Energy on reactant side if the reaction is endothermic.
- Energy on product side if the reaction is exothermic.
- E.g. $H_2O_{(l)}$ + 285.8 kJ → $H_{2(g)}$ + $\frac{1}{2}O_{2(g)}$ (endothermic)
            $H_{2(g)}$ + $\frac{1}{2}O_{2(g)}$ → $H_2O_{(l)}$ + 285.8 kJ   (exothermic)

Method 2: Thermalchemical Equations with Δ H Values

- Enthalpy change is outside the balanced chemical equation.
- ΔH is negative for exothermic reactions
- ΔH is positive for endothermic reactions

E.g. $H_2O_{(l)}$ → $H_{2(g)}$ + $\frac{1}{2}O_{2(g)}$ ΔH = + 285.8 kJ (endothermic)
              $H_{2(g)}$ + $\frac{1}{2}O_{2(g)}$ → $H_2O_{(l)}$ ΔH = − 285.8 kJ (exothermic)

Note that the units are kJ not kJ/mol – this is because the enthalpy change applies to the reactants and products as written. Per mole $H_2O_{(l)}$ in equation 1 and per mole $H_{2(g)}$ in equation 2.

If equation 2 were rewritten:
              $2H_{2(g)}$ + $O_{2(g)}$ → $2H_2O_{(l)}$ then ΔH = − 571.6 kJ

Method 3: Molar Enthalpy of Reaction

- In this method, $ΔH_x$, the energy change associated with the reaction of one mole of a substance.
- $ΔH°_x$ the energy change associated with the reaction of one mole of a substance at 100kPa and a specified temperature. (In the textbook it will always be SATP so you can interchange the 2 values)
- E.g. $ΔH_{decomposition}$ of $H_2O_{(l)}$ = + 285.8 kJ
            $ΔH_{formation}$ of $H_2O_{(l)}$ = − 285.8 kJ

Method 4: Potential Energy Diagram: See diagrams page 318

Homework
- Practice 1,2,3,4,5 and Questions 1,2,3,4