

A decorative graphic consisting of a thin gold circle on the left side. A horizontal bar, divided into a gold left half and a light gray right half, passes through the center of the circle. Large black square brackets are positioned on the left and right ends of the bar.

Chemical Thermodynamics

$$\left[\Delta_r \bar{H}_T^0 \right]$$

- $\Delta_r \bar{H}_T^0$ can be measured from calorimetry.
- However, isn't always possible to isolate the reaction of interest and study it cleanly.
- Consider the creation of $\text{CO}_2(\text{g})$

[Hess's Law]

- Calculate $\Delta_r \bar{H}^0_T$ using a fictitious chemical path.

[Enthalpies of formation]

- In practice, enthalpies are tabulated as enthalpies of formation, $\Delta_f \bar{H}_T^0$.
- Two cautions

$$\left[\Delta_r \bar{H}_T^0 \right]$$

- For a generic chemical reaction, $\Delta_r \bar{H}_T^0$.
- Value is for chemical reaction as written

$$\left[\Delta_r \bar{S}_T^0 \right]$$

- For a generic chemical reaction, $\Delta_r \bar{S}_T^0$.
- Only technically correct at 298K and 1 bar pressure.

$$\left[\Delta_r \bar{G}_T^0 \right]$$

- $\Delta_r \bar{G}_T^0$ has a direct temperature dependence
- Often assume enthalpy and entropy are not temperature dependent.

[Example]

- How much heat is evolved when 50 g of $\text{CH}_4(\text{g})$ is burned at 298 K?

[Example]

- How much heat is evolved when 50 g of $\text{CH}_4(\text{g})$ is burned at 2000 K?

[Example]

- How much heat is evolved when 50 g of $\text{CH}_4(\text{g})$ is burned at 2000 K?
- Consider the temperature dependence of the heat capacities.

Example

- How much heat is evolved when 50 g of $\text{CH}_4(\text{g})$ is burned at 2000 K?
- Consider the temperature dependence of the heat capacities.

Species	a (J/Kmol)	b (J/K ² mol)	c (J/K ³ mol)	ν
$\text{CO}_2(\text{g})$				
$\text{H}_2\text{O}(\text{g})$				
$\text{O}_2(\text{g})$				
$\text{CH}_4(\text{g})$				
Δ				

[Example]

- How much heat is evolved when 50 g of $\text{CH}_4(\text{g})$ is burned at 2000 K?
- Continuing...