

Announcements

- Turn on the Clicker (the red LED comes on).
- Push “Join” button followed by “20” followed by the “Send” button (switches to flashing green LED if successful).
- Deadline for subscription to e-mail list is tomorrow Friday(Sept. 15). ~10 left to sign up.
- Will be starting Chapter 12 next Tuesday. Will put reading and problem assignment on class web site and e-mail it to those signed up for e-mail list. (Probably tomorrow morning).
- Quiz and Worksheet answers will be posted tomorrow as well.
- If you've got questions please come see me. Reminder: my office hours are: 11:30-12:30 MW, 9:30-10:30 TThF or by appointment.

Review

- Calorimetry

- Key relationship: $0 = \Delta H_{\text{RXN}} + C\Delta T \Rightarrow \Delta H_{\text{RXN}} = -C\Delta T$

- Bond energies to calculate ΔH_{RXN}

- Breaking bonds requires putting energy in (+)
(Don't forget to multiply # bonds in molecule by stoichiometric coefficients)

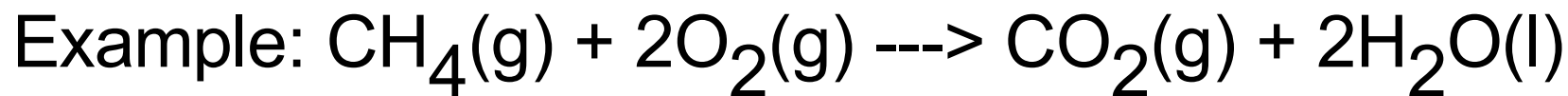
- Making bonds releases energy (-) (Remember stoichiometric coefficients)

- $\Delta H_{\text{RXN}} = \Delta H_{\text{break}} + \Delta H_{\text{make}}$

- ΔH_f° to calculate ΔH_{RXN}

- Key relationship: $\Delta H_{\text{RXN}}^\circ = \sum \Delta H_f^\circ(\text{prod}) - \sum \Delta H_f^\circ(\text{react})$

$$\Delta H^{\circ}_{\text{RXN}} = \sum \Delta H^{\circ}_{\text{f}}(\text{prod}) - \sum \Delta H^{\circ}_{\text{f}}(\text{react})$$



$$\begin{aligned} \Delta H_{\text{RXN}} &= (2 \text{ mol H}_2\text{O})(-285.8 \text{ kJ/mol H}_2\text{O}) + \\ & (1 \text{ mol CO}_2)(-393.5 \text{ kJ/mol CO}_2) \\ & - (2 \text{ mol O}_2)(0 \text{ kJ/mol O}_2) - (1 \text{ mol CH}_4)(-74.8 \text{ kJ/mol CH}_4) = \\ & 890.3 \text{ kJ as written} = \text{ per mol CH}_4. \end{aligned}$$

Molar $\Delta H_{\text{combustion}}$

Compound	Combustion Eq	ΔH as written (kJ)	Molar ΔH (kJ/mol)
CH_4 (Methane)	$\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$	-802.3	-802.3
C_2H_6 (Ethane)	$2\text{CH}_3\text{CH}_3(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$	-2855	-1428
$\text{C}_2\text{H}_5\text{OH}$ (Ethanol)	$\text{CH}_3\text{CH}_2\text{OH}(\text{l}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{g})$	-1234.8	-1234.8
C_8H_{18} (Octane)	$2\text{C}_8\text{H}_{18}(\text{l}) + 25\text{O}_2(\text{g}) \rightarrow 16\text{CO}_2(\text{g}) + 18\text{H}_2\text{O}(\text{g})$	-9356	-4678
$\text{C}_6\text{H}_{12}\text{O}_6$ (glucose)	$\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$	-2537	-2537
H_2	$2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$	-483.6	-241.8

Fuel Values

Compound	Combustion Eq	Molar ΔH (kJ/mol)	Molar Mass (g)	Fuel Value (kJ/g)
CH_4 (Methane)	$\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$	-802.3	16.04	50.02
C_2H_6 (Ethane)	$2\text{CH}_3\text{CH}_3(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$	-1428	30.07	47.49
$\text{C}_2\text{H}_5\text{O}$ (Ethanol)	$\text{CH}_3\text{CH}_2\text{OH}(\text{l}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{g})$	-1234.8	46.07	26.8
C_8H_{18} (Octane)	$2\text{C}_8\text{H}_{18}(\text{l}) + 25\text{O}_2(\text{g}) \rightarrow 16\text{CO}_2(\text{g}) + 18\text{H}_2\text{O}(\text{g})$	-4678	114.23	40.95
$\text{C}_6\text{H}_{12}\text{O}_6$ (glucose)	$\text{C}_6\text{H}_{12}\text{O}_6(\text{s}) + 6\text{O}_2(\text{g}) \rightarrow 6\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$	-2537	180.16	14.08
H_2	$2\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{H}_2\text{O}(\text{g})$	-241.8	2.02	120

Energy per mole CO₂

Compound	Combustion Eq	Molar ΔH (kJ/mol)	kJ/mol CO ₂	Fuel Value (kJ/g)
CH ₄ (Methane)	CH ₄ (g) + 2O ₂ (g) → CO ₂ (g) + 2H ₂ O(g)	-802.3	-802.3	50.02
C ₂ H ₆ (Ethane)	2CH ₃ CH ₃ (g) + 7O ₂ (g) → 4CO ₂ (g) + 6H ₂ O(g)	-1428	-714	47.49
C ₂ H ₆ O (Ethanol)	CH ₃ CH ₂ OH(l) + 3O ₂ (g) → 2CO ₂ (g) + 3H ₂ O(g)	-1234.8	-617.4	26.8
C ₈ H ₁₈ (Octane)	2C ₈ H ₁₈ (l) + 25O ₂ (g) → 16CO ₂ (g) + 18H ₂ O(g)	-4678	-584.75	40.95
C ₆ H ₁₂ O ₆ (glucose)	C ₆ H ₁₂ O ₆ (s) + 6O ₂ (g) → 6CO ₂ (g) + 6H ₂ O(g)	-2537	-422.83	14.08
H ₂	2H ₂ (g) + O ₂ (g) → 2H ₂ O(g)	-241.8		120