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. 14). More than half have signed 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 answer keys will be posted later today.
- If you've got questions please feel free to come see me. Reminder: my office hours are: M 11:30-12:30, TTh 9:30-10, 11-11:30, WF 9:30-10:30, or by appointment.

Review

- Calorimetry
  - Key relationship: $0 = \Delta H_{RXN} + C\Delta T \Rightarrow \Delta H_{RXN} = - C\Delta T$
- 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)
  - $\Delta H_{RXN} = \Delta H_{break} + \Delta H_{make}$
- ΔH^o_f to calculate ΔH_{RXN}
  - Key relationship: $\Delta H^o_{RXN} = \sum \Delta H^o_f(prod) - \sum \Delta H^o_f(react)$

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

Chang Table 6.4

Substance	ΔH^{o}_{f} (kJ/mol)
CH_4	-74.8
C_2H_6	-84.7
C_2H_6O	-277.6
C_8H_{18}	-249.9
$C_6H_{12}O_6$	-1274.4

Molar $\Delta H_{combustion}$

Compound	Combustion Eq	ΔH as written (kJ)	Molar ΔH (kJ/mol)
CH_4 (Methane)	$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$	-802.3	-802.3
C_2H_6 (Ethane)	$2CH_3CH_3(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$	-2855	-1428
C_2H_6O (Ethanol)	$CH_3CH_2OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g)$	-1234.8	-1234.8
C_8H_{18} (Octane)	$2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(g)$	-9356	-4678
$C_6H_{12}O_6$ (glucose)	$C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$	-2537	-2537
H_2	$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$	-483.6	-241.8

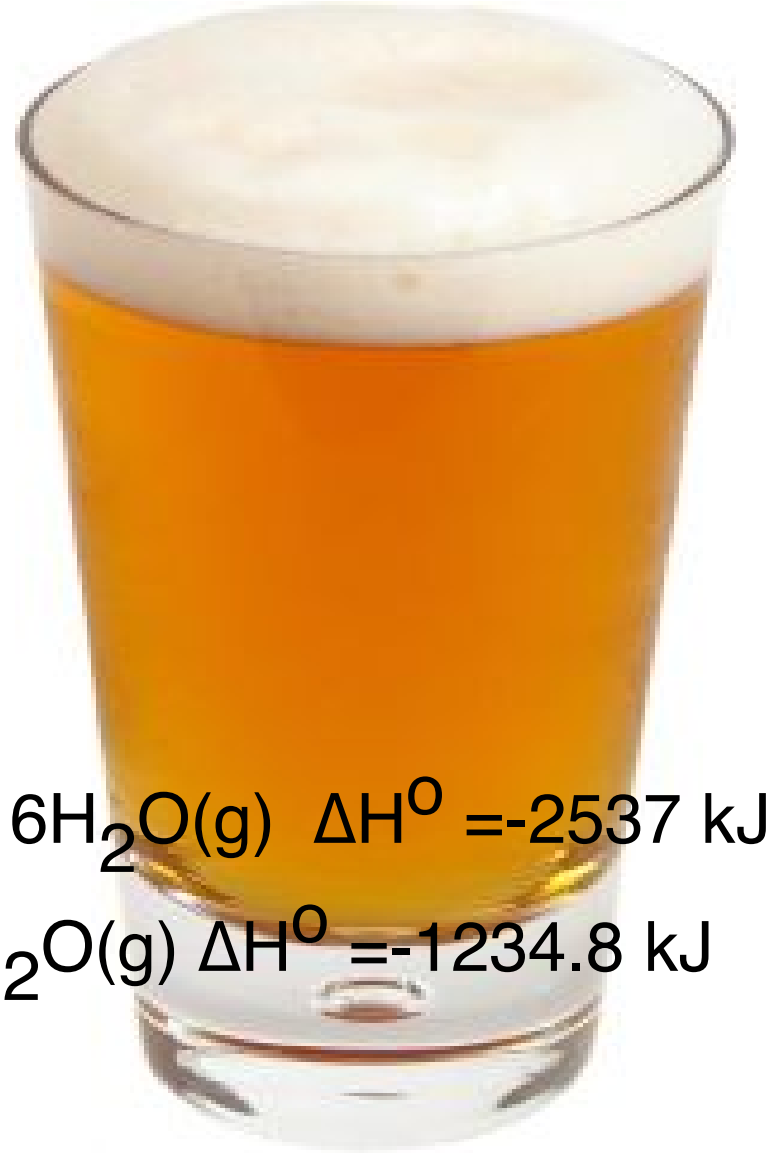
Fuel Values

Compound	Combustion Eq	Molar ΔH (kJ/mol)	Molar Mass (g)	Fuel Value (kJ/g)
CH_4 (Methane)	$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$	-802.3	16.04	50.02
C_2H_6 (Ethane)	$2CH_3CH_3(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$	-1428	30.07	47.49
C_2H_6O (Ethanol)	$CH_3CH_2OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g$	-1234.8	46.07	26.8
C_8H_{18} (Octane)	$2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(g$	-4678	114.23	40.95
$C_6H_{12}O_6$ (glucose)	$C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$	-2537	180.16	14.08
H_2	$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$	-241.8	2.02	120

Energy per mole CO_2

Compound	Combustion Eq	Molar ΔH (kJ/mol)	kJ/mol CO_2	Fuel Value (kJ/g)
CH_4 (Methane)	$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$	-802.3	-802.3	50.02
C_2H_6 (Ethane)	$2CH_3CH_3(g) + 7O_2(g) \rightarrow 4CO_2(g) + 6H_2O(g)$	-1428	-714	47.49
C_2H_6O (Ethanol)	$CH_3CH_2OH(l) + 3O_2(g) \rightarrow 2CO_2(g) + 3H_2O(g$	-1234.8	-617.4	26.8
C_8H_{18} (Octane)	$2C_8H_{18}(l) + 25O_2(g) \rightarrow 16CO_2(g) + 18H_2O(g$	-4678	-584.75	40.95
$C_6H_{12}O_6$ (glucose)	$C_6H_{12}O_6(s) + 6O_2(g) \rightarrow 6CO_2(g) + 6H_2O(g)$	-2537	-422.83	14.08
H_2	$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$	-241.8		120

Why do bacteria make ethanol from sugar?



Because the anaerobic fermentation reaction produces energy: $C_6H_{12}O_6(s)$ ---> $2\ C_2H_6O(l) + 2\ CO_2(g)$ ΔH^o = ?

We already know:

$C_6H_{12}O_6(s) + 6O_2(g) \text{ ---> } 6CO_2(g) + 6H_2O(g)$ ΔH^o =-2537 kJ

$C_2H_6O(l) + 3O_2(g) \text{ ---> } 2CO_2(g) + 3H_2O(g)$ ΔH^o =-1234.8 kJ