W-GC General Chemistry Week 28 4/17

Free energy → capacity to do work

Radiant → energy from the sun
(primary energy source for earth)

Thermal/Motion → Movement of atoms/molecules

$$\text{kinetic energy} = \frac{1}{2}mv^2$$

$$KE = \frac{1}{2}mv^2$$

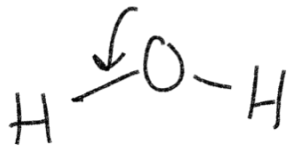
$$E = mc^2$$

Nuclear energy — from nucleus of atom

Potential energy — energy based on position

$$P_E = mgh$$

Chemical energy — bond energy



$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

$\Delta H = -890.4\ kJ/mol$ $\quad -890.4\ kJ \div 4.184\ kJ/cal = 212.8\ kcal$

Change in Enthalpy → change in Bond energy

$A + B \longrightarrow C + D$

200 kJ/mol form $\quad$ 150 kJ/mol form

$\Delta H = H_{prod} - H_{reac}$

$150 - 200$

$-50\ kJ/mol$

Law of conservation of energy → Energy is not created or destroyed, it is converted

nutritional

1 calorie → 1000 cal → 1 kcal

1 kilocalorie

1 calorie is the amount of energy required to raise the temperature of 1 kilogram gram of water by 1 °C

1 cal = 4.184 J

1 kcal = 4.184 kJ

$CH_4(g) + 2O_2 \longrightarrow CO_2(g) + 2H_2O(l)$

200 g CH_4 $\quad \Delta H = -890.4$ kJ/mol

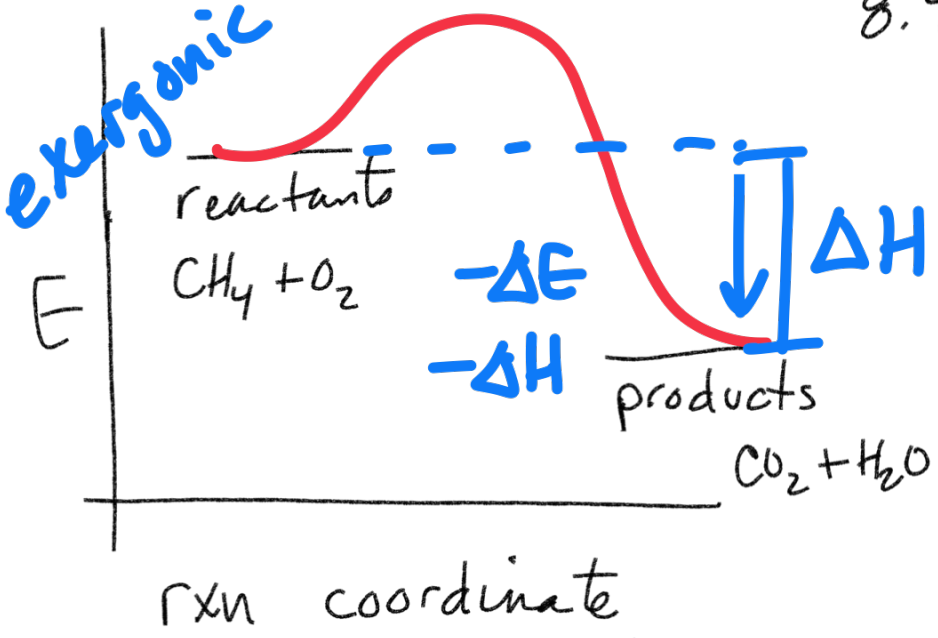
$$200\text{ g } CH_4 * \frac{1\text{ mol } CH_4}{16\text{ g}} * \frac{-890.4\text{ kJ}}{1\text{ mol}}$$

−11,130 kJ

$$50\text{ gal} * \frac{3.78\text{ L}}{1\text{ gal}} * \frac{1\text{ mol}}{22.4\text{ L}} = 8.4\text{ mol}$$

$$8.4\text{ mol} * \frac{-890.4\text{ kJ}}{1\text{ mol}}$$

−7,479 kJ



$-\Delta E$ energy released

exergonic

$\Delta E = \Delta H - T\Delta S$ (Entropy)

$+\Delta E$ energy absorbed

endergonic

$CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

$\Delta H = -890.4\ kJ/mol$

$CO_2 + 2H_2O \longrightarrow CH_4 + 2O_2$

$\Delta H = +890.4\ kJ/mol$

$N_2(g) + O_2(g) \longrightarrow 2NO(g)$

$\Delta H = +66.4\ kJ/mol$

$180g\ N_2$

Boom Boom?

$180g\ N_2 * \frac{1\ mol\ N_2}{28g} * \frac{66.4\ kJ}{1\ mol}$

⊕ endergonic

$426.64 = \boxed{427\ kJ}$

$q = mc\Delta T$

q → amount of energy

$(\text{mass})(\text{specific heat})(\text{change in temp})$

$(100\text{ g})(4.184\text{ J/g}\cdot{}^\circ\text{C})(65^\circ\text{C} - 60^\circ\text{C})$

$= 2092\text{ J}$

exergonic

How much energy was ⊖ released/⊕ absorbed

Rxn = 100 mL of water

[initial temp → 60°C final temp → 65°C]

Mass of water

1 mL of water → 1 gram of water

100 mL → 100 g → 0.100 kg

Specific heat for water 4.184 J/g·°C