

TH-GC General Chemistry Week 29 4/27

Heat of formation ΔH Change in Enthalpy

Ethanol $\boxed{-277.1 \text{ kJ/mol}}$
↑
exergonic

Bond energy

Exergonic/⊖ Release energy
Exothermic
Endergonic/⊕ Absorbed energy
Endothermic

Reaction 150g $\text{C}_2\text{H}_5\text{OH}$
ethanol

How much heat is released?

150g $\text{C}_2\text{H}_5\text{OH}$

$$150\text{g } \text{C}_2\text{H}_5\text{OH} * \frac{1 \text{ mol}}{46.069\text{g}} * \frac{-277.1 \text{ kJ}}{1 \text{ mol}}$$

Molar Mass

$$\text{C } 2 * 12.011 = 24.022$$

$$\text{H } 6 * 1.008 = 6.048$$

$$\text{O } 1 * 15.999 = 15.999$$

$$\hline 46.069 \text{ g/mol}$$

Energy released = $\boxed{-902 \text{ kJ}}$

360g of C_8H_{18}

$$\Delta H = \boxed{-250 \text{ kJ/mol}}$$

1.) Find molar mass $\left\{ \begin{array}{l} 360 \text{ g } C_8H_{18} * \frac{1 \text{ mol}}{114.32 \text{ g}} * \frac{-250 \text{ kJ}}{1 \text{ mol}} \end{array} \right.$

$$8C = 8 * 12.011 = 96.088$$

$$18H = 18 * 1.008 = 18.144$$

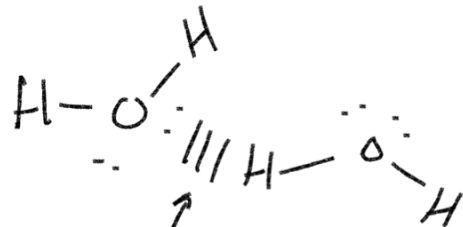
$$\hline 114.232$$

$$\boxed{-787 \text{ kJ}}$$

Water \rightarrow temperature buffer

Hydrogen bonds

take a lot of energy to form and to break 10-30 kJ/mol



hydrogen bond



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

$$1 \text{ calorie} = 4.184 \text{ J}$$

$$q = m c \Delta T$$

↑ heat

↑ mass

↑ specific heat

↑ change in temperature °C

water $c = 1 \text{ cal}$
 specific heat of liquid water 4.184 J



1 mL = 1 g water
 (volume) (mass)

1 mL
 initial temp → final temp
 20°C 60°C

$$q = m c \Delta T$$

$$(1 \text{ g})(4.184 \text{ J/g} \cdot ^\circ\text{C})(60 - 20)^\circ\text{C}$$

$$(1 \text{ g})(4.184 \text{ J/g} \cdot ^\circ\text{C})(40^\circ\text{C}) = \boxed{167 \text{ J}}$$

How much heat was released when
25.5g of H_2O is warmed from

$14^\circ C$ to $22.5^\circ C$

$$C = 4.184 \text{ J/g}\cdot^\circ C$$

$$q = mc\Delta T$$

$$(25.5g)(4.184 \text{ J/g}\cdot^\circ C)(8.5^\circ C)$$

$$907 \text{ J}$$

$$22.5 - 14$$

