

Hess law

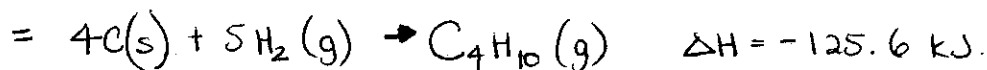
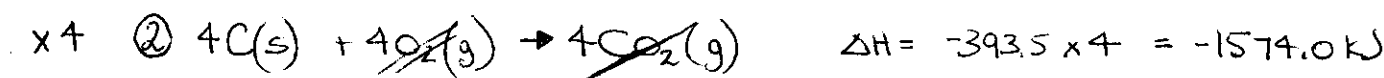
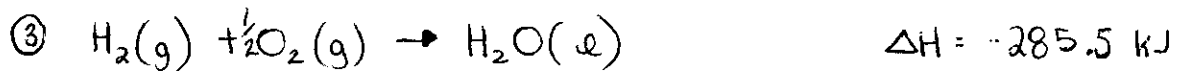
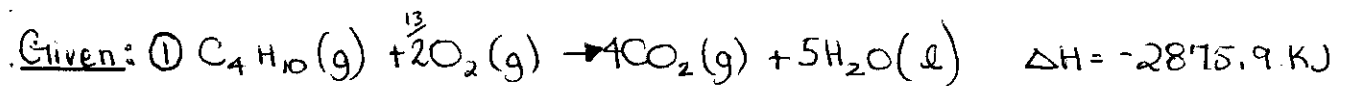
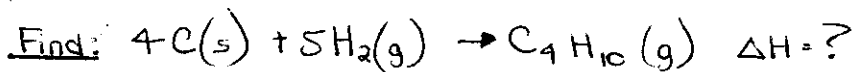
Nov. 18th

limited algebraic manipulation of thermodynamic equations

° Reverse order ΔH changes sign.

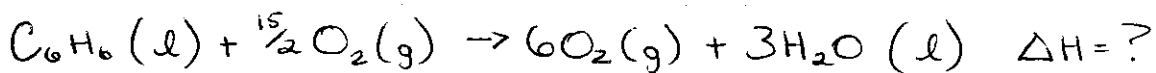
° multiple equation ΔH is multiplied as well.

eg. Determine the heat of formation $C_4H_{10}(g)$ given the heat of combustion of butane is -2875.915 kJ and the heat of formation $CO_2(g)$ is -393.5 kJ and the heat of formation of $H_2O(l)$ is -285.5 kJ .



Determine the heat of formation of benzene $C_6H_6(l)$ given $\Delta H^\circ_{CO_2(g)} = -393.5 \text{ kJ}$ and $\Delta H^\circ_{H_2O(l)} = -285.5 \text{ kJ}$ and the combustion of 5g of benzene is able to warm 5.000 L of water from 20.000°C to 61.814°C .

Write $Q = mc\Delta T$, scale for 1 mol of benzene, $\Delta H = Q$ (Hess' law)



* substance

being warmed

$$Q = mc\Delta T$$

$$Q = ?$$

$$Q = 5000g \times 4.184 \text{ J/g}^\circ\text{C} \times 9.994^\circ\text{C}$$

$$Q = 209075 \text{ J}$$

$$Q = 209.075 \text{ kJ}$$

* substance $m = 5000 \text{ L} \rightarrow 5000g$

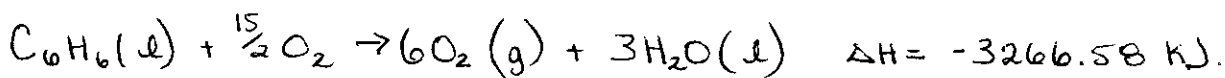
responsible for $C = 4.184 \text{ J/g}^\circ\text{C}$

providing heat $\Delta T = 29.994 - 20.000 = 9.994^\circ\text{C}$

$$\frac{209.075 \text{ kJ}}{5.000g^{**}} \times \frac{78.12g}{1 \text{ mol}} = \frac{3266.58 \text{ kJ}}{1 \text{ mol}}$$

$$\Delta H = -Q$$

$$\Delta H = -3266.58 \text{ kJ}$$



Hess' law

