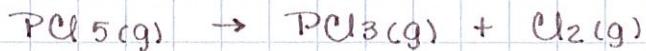


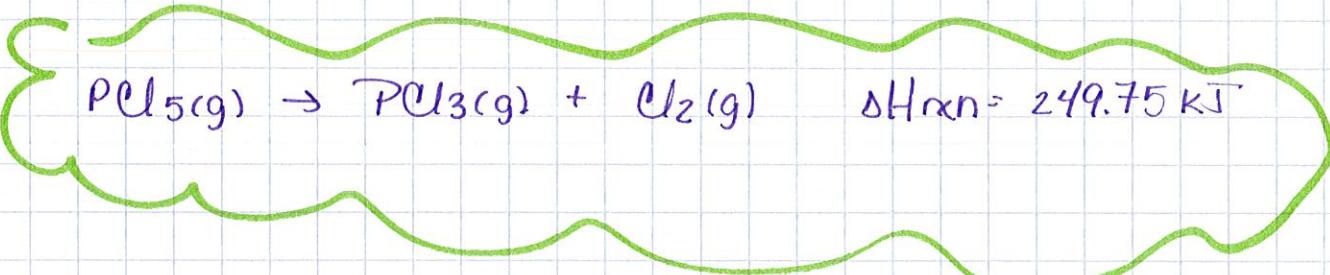
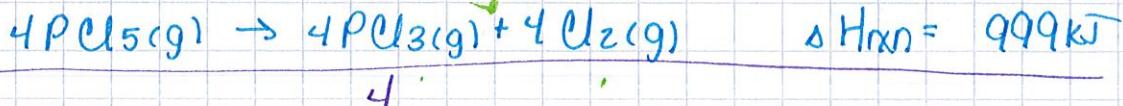
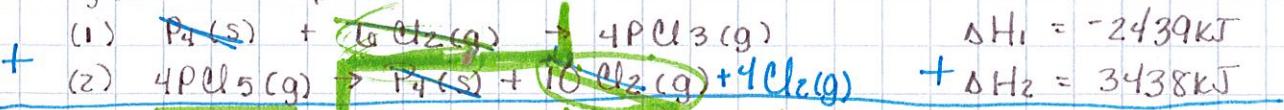
# Practice. - Hess's Law

(1)

- 1) Find  $\Delta H_{rxn}$  for the reaction below:



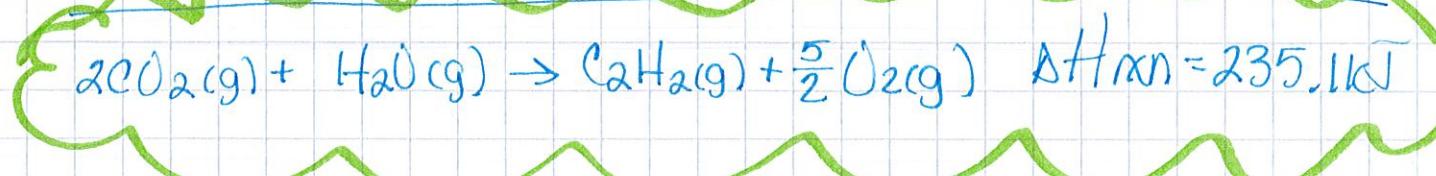
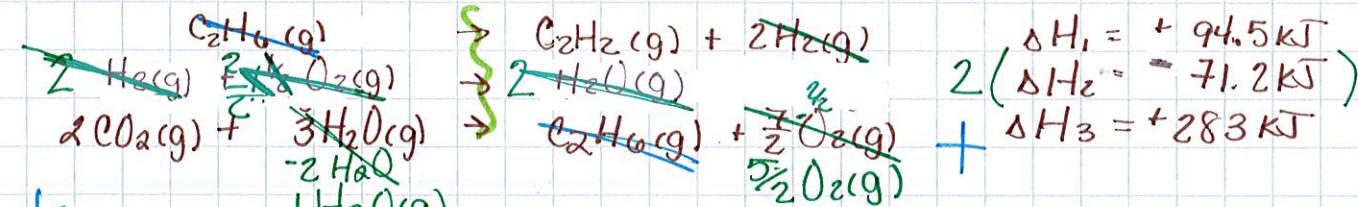
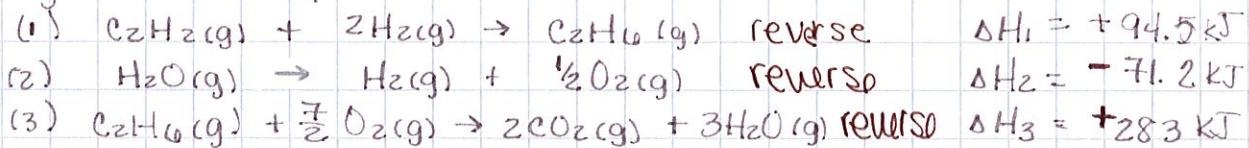
given the steps:



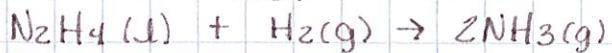
- 2) Find  $\Delta H_{rxn}$  for the reaction below:



given the steps:



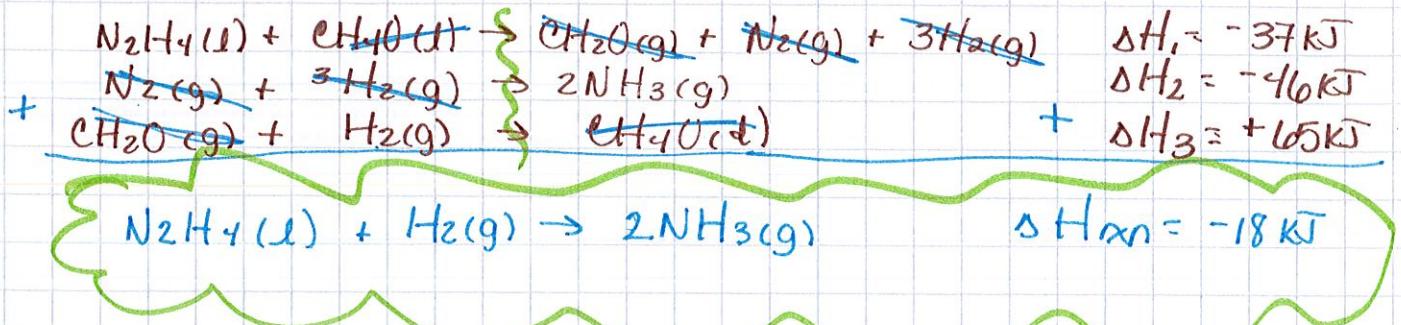
3) Find  $\Delta H_{rxn}$  for the reaction below:



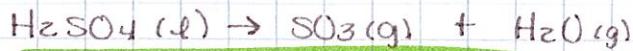
given the steps:

- (1)  $\text{N}_2\text{H}_4(\text{l}) + \text{CH}_4\text{O}(\text{l}) \rightarrow \text{CH}_2\text{O}(\text{g}) + \text{N}_2(\text{g}) + 3\text{H}_2(\text{g})$
- (2)  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
- (3)  $\text{CH}_4\text{O}(\text{l}) \rightarrow \text{CH}_2\text{O}(\text{g}) + \text{H}_2(\text{g})$  reverse

$$\begin{aligned}\Delta H_1 &= -37 \text{ kJ} \\ \Delta H_2 &= -46 \text{ kJ} \\ \Delta H_3 &= -65 \text{ kJ}\end{aligned}$$

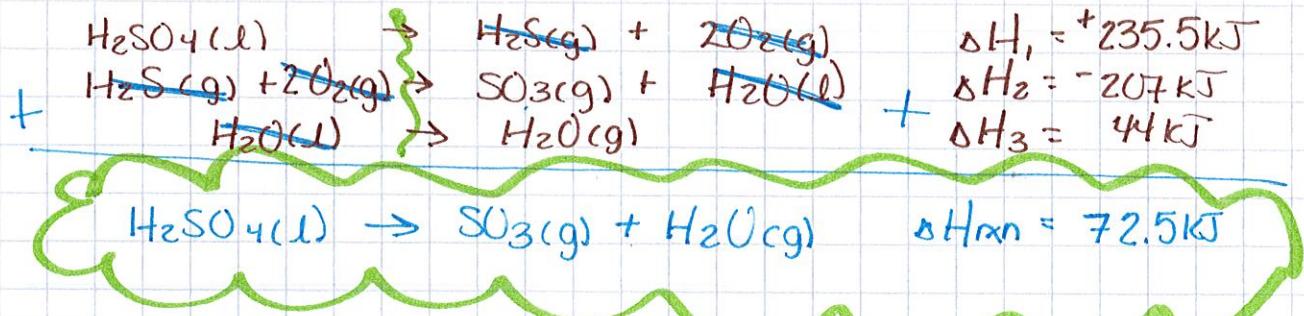


4) Find  $\Delta H_{rxn}$  for the reaction below:



given the steps:

- (1)  $\text{H}_2\text{S}(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{SO}_4(\text{l})$  reverse  $\Delta H_1 = -235.5 \text{ kJ}$
- (2)  $\text{H}_2\text{S}(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{SO}_3(\text{g}) + \text{H}_2\text{O}(\text{l})$   $\Delta H_2 = -207 \text{ kJ}$
- (3)  $\text{H}_2\text{O}(\text{l}) \rightarrow \text{H}_2\text{O}(\text{g})$   $\Delta H_3 = 44 \text{ kJ}$



**Objectives:**

I can...

- Use Hess' Law to determine the heat of a reaction.

1      2      3

**Enthalpy**

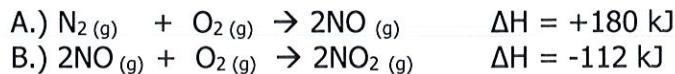
- Amount of heat released or absorbed in a chemical reaction
- State function → depends only upon the *initial and final state* of reactants/products and **NOT** the specific pathway to get from products to reactants.

**Hess' Law**

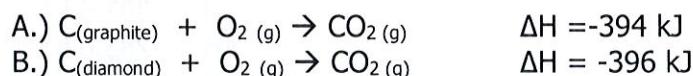
- If a reaction is carried out in a series of steps,  $\Delta H$  for the reaction will be equal to the sum of the enthalpy changes for the individual steps.
- Rearranging stepwise reactions in order to find the overall enthalpy of a reaction

**Examples:**

1. Calculate the  $\Delta H_{rxn}$  of  $\text{N}_2(g) + 2\text{O}_2(g) \rightarrow 2\text{NO}(g)$  based on the following reactions:



2. Calculate the  $\Delta H_{rxn}$  of  $\text{C}_{(\text{graphite})} \rightarrow \text{C}_{(\text{diamond})}$  based on the following reactions:



3. Calculate the  $\Delta H_{rxn}$  of  $2\text{C}_2\text{H}_6(g) + 7\text{O}_2(g) \rightarrow 4\text{CO}_2(g) + 6\text{H}_2\text{O}(g)$  based on the following reactions:

