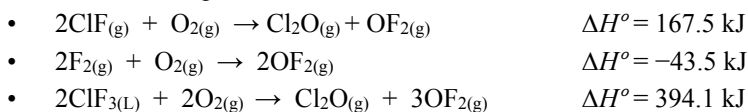
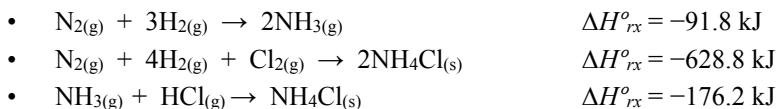


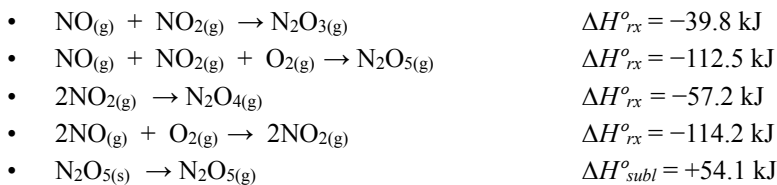
1. Oxidation of ClF by F₂ yields liquid ClF₃. Use the following thermochemical equations to apply Hess' Law and calculate ΔH°_{rx} for the production of ClF₃.



2. Use the following information to find ΔH°_f of gaseous HCl.

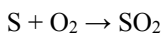


3. The chemistry of nitrogen oxides is very versatile. Given the following reactions and their standard enthalpy changes, calculate the heat of reaction for $\text{N}_2\text{O}_{3(g)} + \text{N}_2\text{O}_{5(s)} \rightarrow 2\text{N}_2\text{O}_{4(g)}$

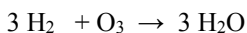


P C.3 (pg 2 of 3)**Hess' Law**

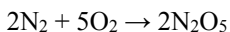
4. Given the following data:

calculate ΔH° for the reaction:

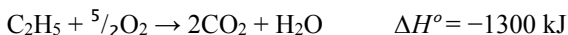
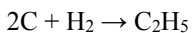
5. Given the following data:

calculate ΔH° for the reaction:

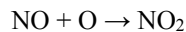
6. Given the following data:

calculate ΔH° for the reaction:

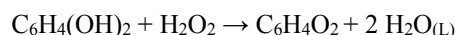
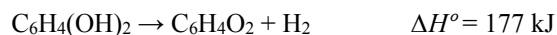
7. Given the following data:

calculate ΔH° for the reaction:

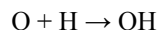
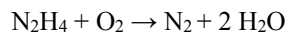
8. Given the following data:

calculate ΔH° for the reaction:

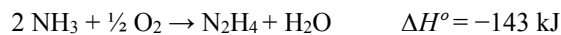
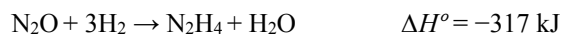
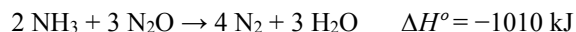
9. The bombardier beetle uses an explosive discharge as a defensive measure. The chemical reaction involved is the oxidation of hydroquinone by hydrogen peroxide to produce quinone and water:

Calculate ΔH° for this reaction from the following data.

10. Given the following data:

calculate ΔH° for the reaction:11. Calculate ΔH° for this reaction

Given the following data.



- $\Delta H_{Rx} = -135.05 \text{ kJ mol}^{-1}$ of ClF_3
- $\Delta H_{Rx} = -92.3 \text{ kJ mol}^{-1}$ of HCl
- $\Delta H_{Rx} = -22.2 \text{ kJ mol}^{-1}$ of $\text{N}_2\text{O}_3(\text{g})$ reacted
- $\Delta H = -296 \text{ kJ}$

choose the second reaction, reverse it and cut the stoich in half to get the single SO_2 on the right. Thus, you need to change the sign of the ΔH and cut the value in half

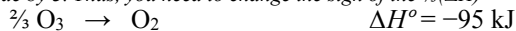


choose the first reaction as is

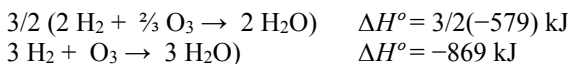


- $\Delta H = -869 \text{ kJ}$

choose the first reaction, reverse it to get the O_3 on the left and divide by 3. Thus, you need to change the sign of the $\frac{1}{3}(\Delta H)$

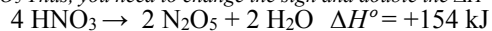


add it to the second reaction as is



- $\Delta H = +30 \text{ kJ}$

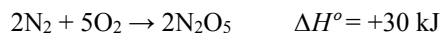
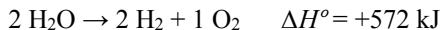
choose the second reaction, reverse it and double the stoich to get the 2 N_2O_5 . Thus, you need to change the sign and double the ΔH



choose the third reaction and quadruple it to eliminate the 4 HNO_3

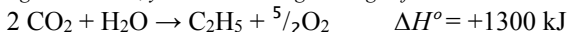


choose the first reaction and reverse it and double it to eliminate the 2 H_2O



- $\Delta H = +226 \text{ kJ}$

choose the first reaction, and reverse it to get the C_2H_5 on the right side. Thus, you need to change the sign of the ΔH



choose the second reaction, double it and reverse it to eliminate the 2 CO_2



choose the third reaction as is to eliminate the H_2O



- $\Delta H = -233 \text{ kJ}$

choose the third reaction as is to get the NO_2 on the right side.



choose the second reaction, cut it in half it and reverse it to get the O on the left side.

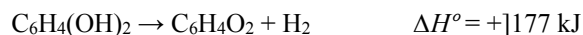


choose the third reaction, reverse it and cut divide the stoichiometry by 2, to leave a single O_3 to cancel

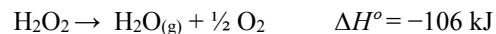


- $\Delta H = -259 \text{ kJ}$

choose the first reaction as is



choose the second reaction and reverse it to get the H_2O_2 on the left.



choose the fourth reaction and double it to get 2 H_2O gas on the right side

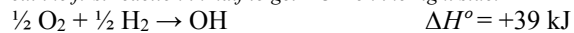


choose the third reaction as is double it to get one H_2 on the left side to cancel with the H_2 in the first reaction.



- $\Delta H = -427 \text{ kJ}$

cut the first reaction in half to get 1 OH on the right side.



choose the second reaction, cut it in half it and reverse it to get the O on the left side.

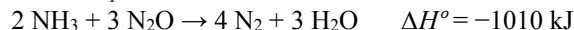


choose the third reaction, reverse it and cut divide the stoichiometry in half, to leave a single H on the left

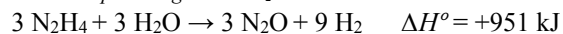


- $\Delta H = -623 \text{ kJ}$

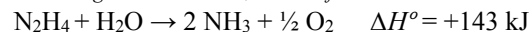
this problem is a bit tricky and would involve lots of fractional stoichiometry unless you quadruple the final reaction - you would find this out as you start off and realize that as you choose the first reaction you would need to divide it by 4 to get only 1 N_2 on the product side.



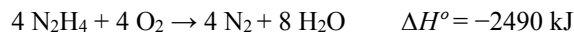
Because N_2H_4 is in two different reactions, you can't use that molecule to help you know what to do, but the N_2O in the first reaction must be removed so choose the second reaction and flip it and triple it to get the 3 N_2O on the correct side.



since that gets 3 N_2H_4 on the left, you need the to flip the third reaction to get the extra N_2H_4 on the left side.



the fourth reaction reaction can be tracked by seeing how many H_2 are needed. The stoichiometry must be multiplied by 9 to eliminate the 9 H_2 from the second reaction above.



now cut the final reaction by 4 to get the correct stoichiometry and the ΔH should be divided by 4 as well to get the correct energy value.

