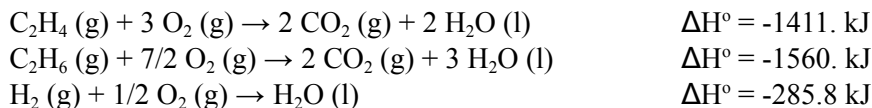


## Hess's Law Worksheet

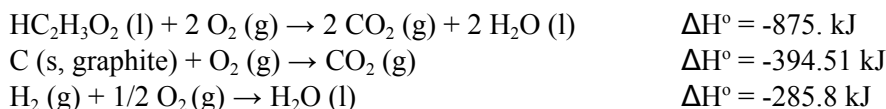
1. Calculate  $\Delta H^\circ$  for the reaction  $\text{C}_2\text{H}_4(\text{g}) + \text{H}_2(\text{g}) \rightarrow \text{C}_2\text{H}_6(\text{g})$ , from the following data.



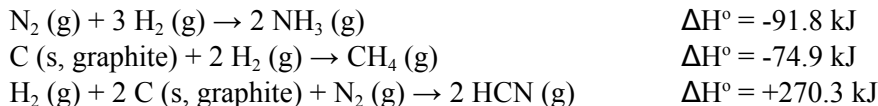
2. Calculate  $\Delta H^\circ$  for the reaction  $4 \text{NH}_3(\text{g}) + 5 \text{O}_2(\text{g}) \rightarrow 4 \text{NO}(\text{g}) + 6 \text{H}_2\text{O}(\text{g})$ , from the following data.



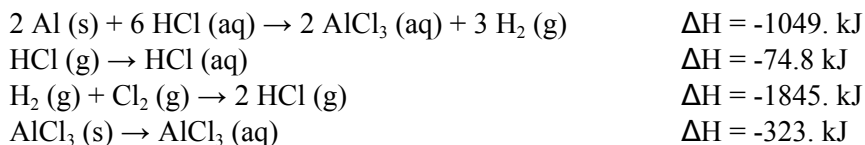
3. Find  $\Delta H_f^\circ$  for acetic acid,  $\text{HC}_2\text{H}_3\text{O}_2$ , using the following thermochemical data.



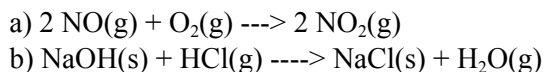
4. Calculate  $\Delta H^\circ$  for the reaction  $\text{CH}_4(\text{g}) + \text{NH}_3(\text{g}) \rightarrow \text{HCN}(\text{g}) + 3 \text{H}_2(\text{g})$ , from the reactions.



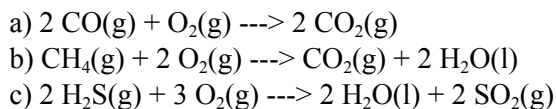
5. Calculate  $\Delta H^\circ$  for the reaction  $2 \text{Al}(\text{s}) + 3 \text{Cl}_2(\text{g}) \rightarrow 2 \text{AlCl}_3(\text{s})$  from the following data.



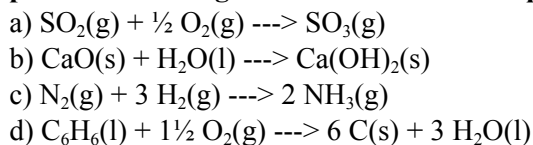
6. Calculate  $\Delta H^\circ$  in kilojoules for the following reactions using a table of standard heats of formation.

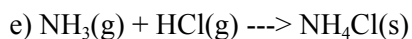


7. Use a standard enthalpies of formation table to determine the change in enthalpy for each of these reactions.



8. Calculate  $\Delta H^\circ$  for these reactions. In each case, state whether the reaction is exothermic or endothermic, rewrite the equation as a thermochemical equation to include the heat term, and indicate whether the products have a greater or smaller enthalpy than the reactants.  $\Delta H_f^\circ$  of  $\text{NH}_4\text{Cl} = 314.4 \text{ kJ/mol}$ .

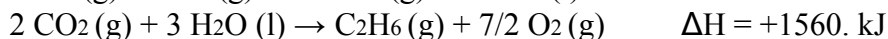
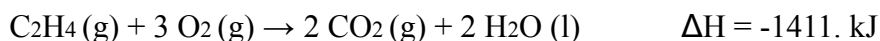




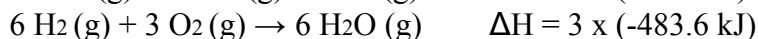
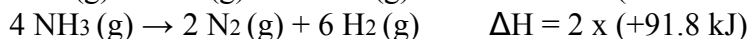
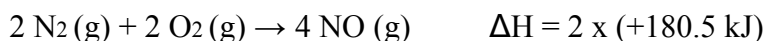
### Solutions

Reactions that were reversed or multiplied by a constant are shown in italics.

#### 1. $\Delta H = -137. \text{ kJ}$

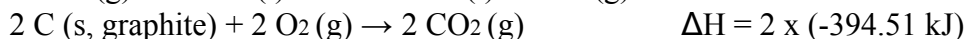
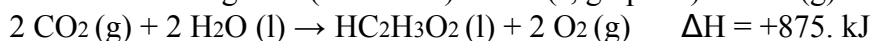


#### 2. $\Delta H = -906. \text{ kJ}$

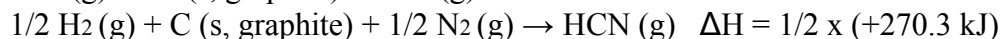
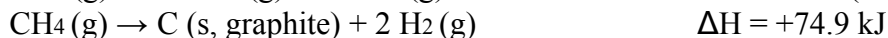


#### 3. $\Delta H_f = -486. \text{ kJ}$

Reaction defining  $\Delta H_f$  ( $\text{HC}_2\text{H}_3\text{O}_2$ ) is:  $2 \text{C}(\text{s, graphite}) + 2 \text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow \text{HC}_2\text{H}_3\text{O}_2(\text{l})$ .



#### 4. $\Delta H = +256.0 \text{ kJ}$



#### 5. $\Delta H = -6387. \text{ kJ}$

