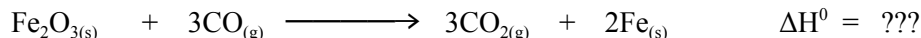


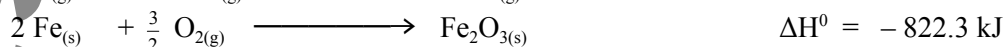
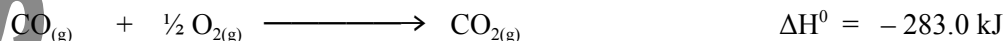
## Assignment: Hess' Law

SCH4U- 2018-2019

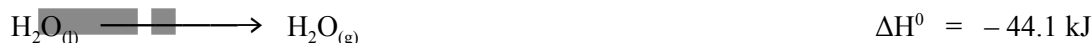
1. One of the methods that the steel industry uses to obtain metallic iron is to react iron (III) oxide,  $\text{Fe}_2\text{O}_3$ , with carbon monoxide,  $\text{CO}$ , according to the following equation:



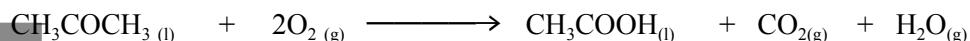
Determine the enthalpy change for the production of iron, given the following:



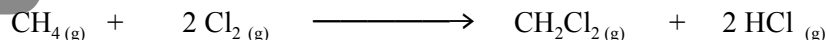
2. Given the following equations:



Determine the enthalpy change,  $\Delta H^\circ_{\text{RXN}}$ , for the following reaction using Hess's Law:



3. Methane,  $\text{CH}_4(g)$ , undergoes an explosive substitution reaction with chlorine gas,  $\text{Cl}_2(g)$ , in the presence of ultra-violet light, a chain initiated by chlorine free radicals, according to:



Calculate the heat of this reaction,  $\Delta H^\circ_{\text{rxn}}$ , using the following data:

Compound	$\Delta H^\circ_f$ (kJ mol <sup>-1</sup> )
$\text{CH}_4(g)$	-74.9
$\text{HCl}(g)$	-92.5
$\text{CH}_2\text{Cl}_2(g)$	-110.5

4. Use the standard enthalpies of formation,  $\Delta H^\circ_f$ , given below:

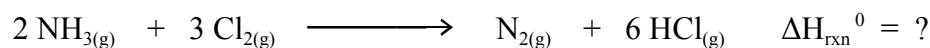
Compound	$\Delta H^\circ_f$ (kJ mol <sup>-1</sup> )
$\text{CO}_2(g)$	-394
$\text{C}_3\text{H}_7\text{OH}(l)$	-304
$\text{H}_2\text{O}(l)$	-286

to calculate the standard enthalpy of combustion of an alcohol  $\text{C}_3\text{H}_7\text{OH}$ , as shown in the equation below:

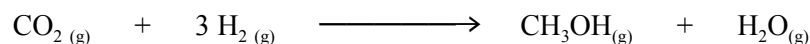


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5. Determine the enthalpy of the following reaction using the Table of  $\Delta H_f^0$  provided:

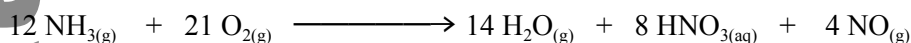


6. Methanol can be synthesized from carbon dioxide and hydrogen according to the following equation:



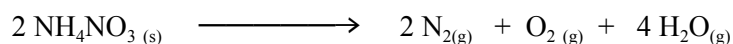
Calculate the enthalpy for the above reaction,  $\Delta H_{\text{rxn}}^0$ , using the Table of  $\Delta H_f^0$  provided.

7. Calculate the  $\Delta H$  for the following reaction using the Table of  $\Delta H_f^0$  provided.



8. Ammonium nitrate ( $\text{NH}_4\text{NO}_3$ ) is easily exploded in the presence of oxidizable impurities and was part of the Oklahoma City bomb and other terrorist attacks. It explodes according to the balanced equation below with a heat of reaction of  $\Delta H = -3076.7 \text{ kJ}$ .

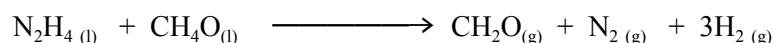
Calculate the standard heat of formation of ammonium nitrate.



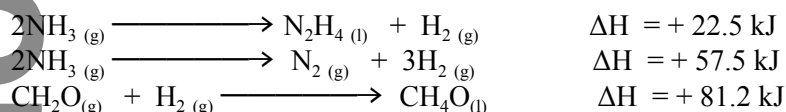
9. Stearin, with formula  $\text{C}_{57}\text{H}_{110}\text{O}_6$ , is a typical fat and its oxidation is an important source of energy in the body. The standard enthalpy change of combustion of stearin in oxygen to give carbon dioxide and liquid water is  $-37.7 \times 10^6 \text{ J mol}^{-1}$ .

- Write a balanced thermochemical equation for the combustion reaction of stearin.
- Use data from the thermochemical tables to calculate the standard enthalpy change of formation of stearin.

10. Determine the  $\Delta H$  for the reaction below,



given the following reactions and the subsequent  $\Delta H$  values:



Mr. Hess